USE OF THE NOAA-2 DIGITIZED SATELLITE DATA FOR DIAGNOSING MARINE FOG IN THE NORTH PACIFIC OCEAN AREA

Ronald Eugene Hale

NPS-51H175091

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

USE OF THE
NOAA-2 DIGITIZED SATELLITE DATA
FOR DIAGNOSING MARINE FOG
IN THE
NORTH PACIFIC OCEAN AREA

by

Ronald Eugene Hale

September 1975

Thesis Advisor: Robert J. Renard

Approved for public release; distribution unlimited.

Prepared for
Naval Air Systems Command
Washington, D.C. 20360

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NPS-51H175091
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): Use of the NOAA-2 Digitized Satellite Data for Diagnosing Marine Fog in the North Pacific Ocean Area
5. TYPE OF REPORT & PERIOD COVERED: Master's Thesis; September 1975
6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Ronald E. Hale In conjunction with Robert J. Renard
8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Postgraduate School Monterey, California 93940
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 62759N; N000 19-76-WR 61240
11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Air Systems Command, 370C Washington, D.C. 20360
12. REPORT DATE: September 1975
13. NUMBER OF PAGES: 92
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): Naval Postgraduate School Monterey, California 93940
15. SECURITY CLASS. (of this report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

fog; marine fog; weather satellite; North Pacific Ocean; ocean fog; NOAA-2 satellite data; meteorological satellite; marine visibility

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Digital NOAA-2 visual and daytime infrared satellite data and marine surface synoptic reports, North Pacific Ocean, July 1973, are computer processed and diagnosed in an attempt to develop a scheme for identifying fog over open ocean areas as a function of satellite information only. Using approximately 3250 ship observations as ground-truth data, present and past weather, visibility, and cloud cover and type, were sorted into eleven categories and

DD FORM 1 JAN 73 1473 (Page 1) EDITION OF 1 NOV 65 IS OBSOLETE S/N 0102-014-6601 |

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

related to the satellite data observed within two hours of the ship report. Critical visual (brightness) and infrared (temperature) count values, separately and in combination, are specified for the purpose of discriminating fog from no-fog marine areas.

Satellite count-value distributions for select categories are illustrated by histograms; the relative accuracies in separating fog from no fog as a function of visual and infrared count values are shown by skill-score analyses.

USE OF THE NOAA-2 DIGITIZED SATELLITE DATA FOR DIAGNOSING MARINE FOG IN THE NORTH PACIFIC OCEAN AREA

by

Ronald Eugene Hale
Lieutenant, United States Navy
B.S., University of Missouri, 1968

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN METEOROLOGY

from the

NAVAL POSTGRADUATE SCHOOL
September 1975

NAVAL POSTGRADUATE SCHOOL
Monterey, California

Rear Admiral Isham Linder
Superintendent

Jack R. Borsting
Provost

This thesis prepared in conjunction with research supported by the Naval Air Systems Command 370C under Work Request 61240.

Released as a
Technical Report by:

ABSTRACT

Digital NOAA-2 visual and daytime infrared satellite data and marine surface synoptic reports, North Pacific Ocean, July 1973, are computer processed and diagnosed in an attempt to develop a scheme for identifying fog over open ocean areas as a function of satellite information only. Using approximately 3250 ship observations as ground-truth data, present and past weather, visibility, and cloud cover and type, were sorted into eleven categories and related to the satellite data observed within two hours of the ship report. Critical visual (brightness) and infrared (temperature) count values, separately and in combination, are specified for the purpose of discriminating fog from no-fog marine areas.

Satellite count-value distributions for select categories are illustrated by histograms; the relative accuracies in separating fog from no fog as a function of visual and infrared count values are shown by skill-score analyses.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

Figure

LIST OF TABLES

ACKNOWLEDGEMENTS

The author would like to express his deepest appreciation to Dr. Robert J. Renard for his guidance, assistance and constructive criticism throughout the course of this study.

Appreciation is also extended to the Naval Weather Service Detachment, Asheville, North Carolina, for providing NOAA-2 digital satellite data and the synoptic ship observations used in the study; to the Environmental Prediction Research Facility, Monterey, California, particularly to Mr. Roland Nagle for his valuable assistance in developing the "earth-location" procedures used in the study; and to Mr. Russell Schwanz for his computer programming assistance.

Finally the author wishes to express his deepest thanks to his wife, Joy, and children for their patience, understanding, and unfading moral support during the course of this study.

I. INTRODUCTION AND BACKGROUND

The existence of marine fog poses a potential threat to all ship operations at sea. Both commercial and military shipping are faced with possible property and personnel losses due to collision and costly schedule delays resulting from reduced speeds during periods of low visibility in marine fog. In addition, many Navy operations such as aircraft launch and recovery, multi-ship training maneuvers, and underway replenishment are severely hampered by the reduction in horizontal visibility due to marine fog. The impact of marine fog on the United States Navy has been addressed in terms of losses in lives and revenue during the five-year period from 1969 to 1974. (Wheeler, 1974)

It is evident that an accurate depiction of fog regions over the open ocean would be of significant value in the selection of areas for short- or long-range sea and air operations dependent on good visibility for successful completion. The knowledge of these fog regions could also influence ship routing procedures.

The Departments of Meteorology and Oceanography, Naval Postgraduate School, (NPS), Monterey, California are actively involved in research relating to marine-fog analysis and the development of fog forecasting procedures. A portion of the NPS group has addressed the problem of marine-fog climatology and are pursuing further refinements

of a method to specify fog duration, and hence frequency, from the visibility-weather group elements of the primary synoptic report in order that frequencies of marine-fog occurrence may be derived. (Renard, Englebretson, and Daughenbaugh, 1975; Willms, 1975)

High quality marine-fog forecasts are of operational importance, but a forecast can be no better than the data base from which it was made. Climatology may be used as the data base at locations where current observations are not available, but it has apparent limitations in areas outside the normal shipping lanes where the data coverage is historically sparse. Ideally, the meteorologist would like a mechanism for data gathering which provides good temporal and spatial continuity of fog occurrence for diagnosing marine fog. The meteorological satellite may hold the key to such marine-fog surveillance. A pilot study using visual and infrared satellite imagery as a means of discerning the presence of marine fog has been accomplished (Wallace, 1975), indicating the need for further investigations into the use of digital satellite data for detecting marine fog.

The only known objective technique which predicts fog occurrence over large ocean areas, such as the North Pacific Ocean, is the model currently being used by Fleet Numerical Weather Central (FNWC), Monterey, California. Their operational product, called FTER, is based on the statistical processing of certain fog related parameters within FNWC's Primitive Equation (P.E.) Model and is provided twice daily

(verifying at 0000 and 1200 GMT) in a fog-probability format for forecast intervals from zero to 72 hours. Although an extensive evaluation of this product has not been conducted to date, its accuracy is believed to be similar to that of a credible climatology in depicting regions of marine-fog occurrence and thus is not at a totally acceptable level for operational purposes. If it can be determined that marine fog is discernable by current meteorological satellite sensors, then a real-time diagnosis of fog distribution may be possible at long last, thus providing an input data base from which improved fog forecasts can be produced.

II. OBJECTIVE AND APPROACH

The primary objective of this study was to develop a procedure for evaluating digital visual and/or infrared data from meteorological satellites for the purpose of determining the value of such data in diagnosing the spatial extent of marine fog over the open ocean.

The approach taken to achieve this study's objective was to process and quantitatively interpret digital satellite data in an attempt to outline, with a reasonable degree of accuracy, regions where marine fog exists. "Cutoff" brightness (visual) and temperature (infrared) values were statistically determined to optimize the skill in specifying fog/no-fog boundaries, utilizing conventional ship data as "ground truth" verification.

III. DATA

A. SURFACE SHIP REPORTS

Primary-time synoptic weather observations from transient ships for July 1973 were the main source used to establish the basic "ground truth" for the existence or nonexistence of marine fog. In addition, the three-hourly reports from ocean station vessels PAPA (50N145W) and NOVEMBER (30N140W), as well as the few available "off-time" transient ship weather reports, were incorporated into the "ground-truth" data base. These ship data were obtained on magnetic tape from the National Climatic Center (NCC), via the Naval Weather Service Detachment (NWSD), both located in Asheville, North Carolina. Ship data for the period 11-15 July 1973 were not available at the NCC and hence were not used in this study.

B. METEOROLOGICAL SATELLITE DATA

NOAA-2 (ITOS-D) satellite data were chosen for this study since readout information (direct or archived) from the NOAA-2 satellite is available to both civilian and military activities worldwide. In addition, previous work on the discernment of marine fog from satellites (Wallace, 1975) utilized the NOAA-2 data.

Digitally composited data for the scanning radiometer daytime visual (SRVIS) and daytime infrared (SRIR-DAY) were provided on magnetic tape by the NCC through the NWSD,

Asheville, North Carolina, for the period 1-31 July 1973. Nighttime infrared (SRIR-NIGHT) data were also requested for the same period but were not received in time to be incorporated into this study. In addition, 10 x 10 inch photographic prints of digitally-composited mosaics for the Northern Hemisphere, both SRVIS and SRIR-DAY, were provided by the Environmental Prediction Research Facility (EPRF), Monterey, California. The mosaics and the digital data on magnetic tape were originally processed by the National Environmental Satellite Service (NESS), Washington, D. C..

For the data period processed, the NOAA-2 satellite was in a circular, sun-synchronous, near-polar orbit at an average altitude of 1451 km above the earth's surface. The average nodal (orbital) period was 115 minutes and the earth rotated 28.75 degrees between each orbital track, resulting in approximately 12.5 orbital passes every twenty-four hours. The SRIR-DAY and SRVIS data were obtained while the satellite was southbound on the daylight side of the orbit with the satellite subpoint of each orbit crossing the equator at the descending node longitude near 0900 local time each day.

The NOAA-2 scanning radiometer has two channels: a visible channel (SRVIS) with a spectral response from 0.2 to 0.7 μm and a resolution at the nadir point (directly beneath the satellite) of about 4 km; and an infrared channel (SRIR) with a spectral response from 10.5 to 12.5 μm and resolution of about 8 km at the nadir point. The resolution at 1600 km either side of nadir is about 8 to 12 km

for the visible channel and about 16 to 25 km for the infrared channel (National Environmental Satellite Service, 1973).

The NOAA-2 satellite also carries a Very High Resolution Radiometer (VHRR) with 1 km resolution in both the visible and infrared channels. However, the VHRR NOAA-2 data, acquired through direct readout by three NOAA stations, and limited to the acquisition range of the stations were not archived and thus were not available for the study period.

C. SEA-LEVEL PRESSURE ANALYSES

The Northern Hemispheric sea-level pressure analyses, originated by the National Meteorological Center (NMC), Suitland, Maryland were provided on microfilm for the study period by the EPRF, Monterey, California. The surface analyses were used to relate processed satellite data to the general synoptic weather patterns such as major low pressure systems and associated frontal activity.

IV. PROCEDURES

A. SELECTION OF AREA AND TIME PERIOD FOR STUDY

Since the presence of fog is related to thermally stable low-level atmospheric conditions, maximum aerial coverage of marine fog would be expected during a period when the variation in sea-level pressure was at a minimum and the baroclinicity of the atmosphere was weak. In the Northern Hemisphere, the summer season, particularly the month of July, appears to best meet these conditions since the annual deviation of sea-level pressure is lowest (Hesse and Stevenson, 1968) and the extratropical storms reach their northernmost mean track during this period. The month of July 1973 was selected as the time period for this study.

Figures 1 and 2, (Willms, 1975) indicate that for the month of July the North Pacific Ocean provides the highest frequency of fog occurrence north of the Kuroshio Current (approximately 40N) and west of 155W where a southerly component of the surface wind advects the relatively warm, moist air of the subtropical region over the colder waters of the polar region. Thus the oceanographic region shown in Figures 1 and 2, which extends approximately from 30N to 60N latitude between 115W and 135E longitude, was chosen for this study. This area allowed the entire gamut of fog frequencies, from maximum to minimum, to be observed so that the critical boundaries between fog and no fog could be investigated.

Since the NMC sea-level pressure analyses, the NOAA-2 mosaics, and the NOAA-2 digital data on magnetic tapes were provided on polar stereographic projections of various scales, simply expanding the material to a 1:15 million scale proved to be the most practical means of processing and displaying the data involved in this study.

B. PREPARING SEA-LEVEL PRESSURE ANALYSES

The NMC sea-level pressure analyses, which were provided on microfilm, were photographically enlarged to 1:15 million charts for the study area. This projection allowed for the sea-level pressure analyses to be overlayed with the appropriate computer output of processed satellite data so various synoptic features on the charts could be related when establishing fog/no fog boundaries.

C. PROCESSING SURFACE SHIP DATA

The surface ship data, received on magnetic tape (TDF-11 format), were scanned and reports within the time-frame and geographic area of the study were transferred to an NPS magnetic tape in a format convenient for processing. Each day of ship reports was placed on a separate file for easy access by future programs in the study, and the reports were checked for duplication using the ship's international call sign, latitude, and the date-time group (DTG) of the report as criteria for duplication. Approximately 3% of the 3585 ship reports scanned were found to be duplicates and were removed from the data base.

D. PROCESSING NOAA-2 DIGITAL DATA

The NOAA-2 SRVIS and SRIR-DAY digital data were provided on magnetic tape in the format shown in Figure 3. The 2048 x 2048 grid-point array of digital data available on each magnetic tape (Figure 3A) coincides with the 20.7 x 20.7 cm imagery area contained on each 10 x 10 inch mosaic print (Figure 3B) and has a meshlength resolution of approximately 6.1 nmi at 60N and 4.9 nmi at 30N latitude. A more detailed schematic of the mosaic background is provided in Figure 4A showing the study area within the shaded portion. The rectangular boundary incorporating the study area (Figure 4B) represents the outer limits of the data points extracted from the larger 2048 x 2048 array for use in this study. This rectangular region was oriented for convenience of processing so that the rows and columns of the study area grid (sub-grid) parallel the rows and columns of the larger rectangular grid. The actual grid points (rows and columns) from the larger grid, used as boundaries for the sub-grid, were determined by (1) measuring the linear distance from the first row or column of the large grid to the corresponding boundary of the sub-grid, (2) dividing this measured distance by the total length of the larger grid (20.7 cm) to produce a simple, linear ratio, and (3) multiplying the resulting ratio by the total number of grid spacings (2047) for the large grid. Thus, the sub-grid corresponded to rows 608 through 1475 and columns 440 through 759 of the larger grid resulting in a 320 x 868 grid array. The geographical

location (latitude and longitude) of each sub-grid boundary corner are displayed in Figure 4A.

Each grid point extracted from the magnetic tape consists of one SRIR-DAY count value and one SRVIS count value. The SRIR-DAY digital count values are representative of radiation emitted from land, sea and cloud surfaces. They range from 0 to 255 with the lower end of the count scale corresponding to colder temperatures (higher clouds) and the higher values corresponding to warmer temperatures (low or no clouds). SRVIS count values are related to albedos of land, sea and cloud surfaces. They range from 0 to 255, with low order values indicating darker areas (low or no clouds) and high values corresponding to brighter areas (high level clouds). Missing data were indicated by the count value of 255 for both the SRVIS and the SRIR-DAY data.

The spacing between grid points needed to obtain a 1:15 million polar stereographic projection of the sub-grid area was found using an expansion factor of 7.76 applied to the sub-grid outlined on the NOAA-2 mosaic (Figure 4A). This expansion factor was determined by dividing the distance from 20N to the North Pole on a 1:15 million polar stereographic chart (62.9 cm) by the corresponding distance on the 20.7 x 20.7 cm NOAA-2 mosaic (8.1 cm).

The digital satellite data for the sub-grid area were analyzed utilizing the program CONTUR, a system routine in the general purpose NPS library which displays the analyzed charts on a CALCOMP plotter. Due to output size limitations

of the CONTUR routine, the sub-grid (320 x 868) was divided into three equal sections (see Figure 4B) resulting in a 320 x 290 grid array for each section. Also, the CONTUR routine was not capable of processing the number of grid values used in each section so the meshlength was increased by fourfold along each row and column (using every fourth grid point). Thus an 80 x 73 grid field was used to provide input data for each CONTUR section.

Each of the three output analysis sections from the CONTUR routine were then taped together forming a 1:15 million polar stereographic projection for each day which could be used in register with the NMC sea-level pressure analyses or used to merge the SRIR-DAY and SRVIS analyses when diagnosing fog/no-fog boundaries. Comparing this coarse array (80 x 217) with the original finer mesh array (320 x 868) for a small test area indicated little or no degradation of the SRIR-DAY or SRVIS analyses. The major effect was to smooth out much of the "bumpiness" of the contour lines resulting in isolines which were easier to work with when diagnosing fog/no-fog boundaries. This coarse meshlength was utilized only for the display output of the CONTUR routine; the original fine meshlength was retained when correlating the digital count values with "ground-truth" information.

E. "EARTH LOCATION" AND CALIBRATION OF NOAA-2 DIGITAL DATA

Since the satellite SRIR-DAY and SRVIS data were stored on the magnetic tape in polar stereographic coordinates,

each grid point was located by knowing only its x-distance and y-distance on the sub-grid (i.e. location by column and row). The positions of the corresponding ship reports were determined by latitude and longitude. Thus a software scheme was developed which converted the latitude and longitude position of a ship report within the sub-grid to the row and column at that position. This "earth location" was accomplished using trigonometric identities as depicted in Appendix A.[1]

Following development of the "earth location" program, the next step was to test the scheme to determine its accuracy. This was achieved by initially setting all the grid points in the 320 x 868 array to zero, then bogusing in a known constant at designated latitude and longitude positions within the sub-grid area. The array was then analyzed using the CONTUR subroutine, resulting in concentric "bulls-eyes" at the bogus points. The output was superimposed on a 1:15 million polar stereographic projection chart and the bogus points were compared with corresponding latitude and longitude positions on the chart. (See Figure 5.) Since the polar stereographic projection used was "true" at 60N, the location of the bogus points were also assumed to be accurate at 60N. It was found that the error below 60N increased with decreasing latitude, to the extent that the error of the points at 30N was approximately ± 10 nmi. Discussions

---

[1] The development of the "earth location" program was accomplished with the assistance of Mr. R. Nagle, EPRF.

with personnel in the Satellite Department at EPRF indicated the "earth location" accuracy of the NOAA-2 satellite was approximately ± 30 nmi, thus, the accuracy of the "earth location" program was believed sufficient for purposes of this study.

F. TIME COMPATABILITY OF SHIP AND SATELLITE DATA

Tabulation of the orbit numbers, descending node longitudes, and the hour, minute and second of the equator crossing at the descending node longitude for each orbit within the sub-grid area were made for each day during the month of July 1973. It was found that the orbital track of the NOAA-2 satellite repeated a given descending node longitude crossing approximately once every 23 to 25 days with the time of the two crossings differing by only approximately two to three minutes. This time difference was considered negligible for the purposes of this study so each descending node longitude was assigned one equator crossing time.

Selected orbits were plotted to determine the best cut-off boundaries between times of ship data such that the ship reports used for "ground truth" would be within approximately ± two hours of the time of the satellite data at a given location. (See Figure 6.) This boundary selection was complicated by two factors. First, the orbits, as shown in Figure 6, correspond to the paths followed by the subsatellite point and cross the sub-grid area at an angle making it difficult to choose a row within the sub-grid array which best separates the satellite orbits. Secondly, the scanning

radiometer obtains a continuous strip image, or swath, along the orbital track which extends approximately 2500 kilometers (km) either side of the subsatellite point. This resulted in considerable overlay in coverage between consecutive swaths in the northern latitudes. With the NOAA-2 data, the overlap between successive swaths was eliminated by retaining only the latest data. Thus, the western edge of each orbit was replaced by data from the next orbit when producing the composited NOAA-2 mosaic. Taking these factors into account, the cutoff boundaries (shown in Figure 6) were determined, which retained as "ground truth" the ship reports approximately two hours either side of the nadir point. This ± two-hour criteria, in essence, assumes that the cloud conditions observed by the satellite at a given location existed at that location for the past two hours and would continue to persist for the next two hours. It is believed that any error in SRIR-DAY and SRVIS count values introduced by this assumption would be negligible within the study area during the summer months, except perhaps in the vicinity of moving frontal systems. If a more restrictive time constraint were placed on the "ground truth," it would have significantly reduced the verifying data base to the extent that a much larger time period would need to be studied to retain statistical reliability of the results; moreover, there would be portions of the study area, between primary synoptic times, which would be nearly void of "ground truth," making verification of those areas virtually impossible.

Thus the "processed" surface ship data were scanned, retaining only those which met the above time constraints, resulting in a data base for the time period of the study of approximately 3471 reports. The ship reports retained to this stage of the study were then "earth-located" to obtain their SRIR-DAY and SRVIS count values and scanned to eliminate those reports with missing SRIR-DAY and/or SRVIS data. The ship data which remained at this point constituted the data base used for this study (3257 reports).

G. CATEGORIZATION OF SHIP DATA

After the ship data were screened for time compatibility, they were then assigned one of eleven categories as depicted in Table I. The categories were designed to aid in the selection of cutoff count values between fog and no fog from which a fog/no-fog boundary could be diagnosed. A few of the fog categories had limitations. For example, Category 6 included only those fog reports whose total cloud amount (N) was at least three-eighths greater than the low cloud amount (NL), which indicated a potential for higher-cloud "contamination." Since the majority of ships reporting fog also reported an obscuration of the sky, segregation of fog reports with higher-cloud "contamination" became a problem primarily when fog was reported within frontal bands where multilevel clouds existed over the fog. Further, it may be noted from Table I that Categories 1 through 4 do not contain a sufficient number of ship reports to be statiscally useful when studied individually. Also, Category 10

reports were removed from the data base at this point, since this category indicates missing satellite data.

H. DETERMINATION OF SRIR-DAY AND SRVIS CUTOFF COUNT VALUES

In resolving cutoff count values (see Section D) for fog, it was necessary to find SRIR-DAY and SRVIS values which would best distinguish between clear conditions and fog on one end of the fog scale and between fog and stratus and/or higher clouds on the other end of the scale. One would expect the separation between clear and fog areas to be reasonably distinct except possibly when the fog was shallow and/or light such that the fog related IR temperatures sensed were near those of the sea surface in adjacent clear areas and the brightness of the fog area was minimal. The primary problem arose when attempting to separate fog from stratus since, by definition, fog is a stratus cloud based at the surface.

Essentially, three approaches were used to determine the cutoff count values between fog and no-fog ship reports.

1. Histograms

In the first appraoch, the ship data were sorted into the eleven categories and histograms were prepared for each category (except Category 10) for both SRIR-DAY and SRVIS data. Figures 7-12 show selected categories. By analyzing the distribution of count values for these selected categories, a range of cutoff values was subjectively determined. Figures 7A and 7B show the entire spectrum of

SRVIS and SRIR-DAY count values, respectively, for all the ship reports utilized in the study.

When comparing Category 5 (heavy fog) to Category 9 (clear sky) (see Figures 8 and 11), it was found that a relatively narrow range of count values could be subjectively established between clear skies and fog conditions. The lower cutoff value for fog in the SRVIS display was estimated to range from 45 to 60 (Figures 8A and 11A) while the boundary between clear skies and fog from SRIR-DAY data is best located in the IR range 160 to 175 (Figures 8B and 11B). Figures 9A and 9B show the range of count values for past-weather fog; Figure 9A indicates a relatively broad spectrum, making the boundary determination extremely difficult.

A usable cutoff range between fog and either stratus or higher level clouds was almost impossible to assess using histograms (compare Figure 8 with Figures 10 and 12). When using SRIR-DAY values, the differentiation is especially complicated because the tops of the fog layer and stratus are nearly the same height and thus the temperature in both cases would also be similar, resulting in nearly identical count values (Figures 8B and 10B).

Also the distinction between fog and high-level clouds in SRIR-DAY imagery may be obscurred due to the "high level" contamination of fog reports discussed previously in Section II. G, especially within frontal bands as well as due to the tenuousness of summer-time middle/high clouds

(Figures 8B and 12B). The SRVIS appeared to have an upper boundary cutoff fog value within a relatively large range of 150 to 200 (Figure 8A). The lower boundary cutoff for SRIR-DAY was found to be between 50 and 70 (Figure 8B). Since the range of cutoff values obtained using histograms was too broad and subjective, an alternative was sought which would reduce the cutoff ranges.

2. Skill Score Analyses

A second approach used to narrow the cutoff ranges for fog involved the analyses of skill scores. Computer software was developed which inputed arbitrarily chosen cutoff values of SRVIS and SRIR-DAY for diagnosing fog and outputed an array of skill scores using the July 1973 ship observations as verifying "ground truth." The skill scores, computed from selected upper and lower cutoff values for fog, were determied from contingency-table information outlined in Figure 13A; in this case, the scores indicate the ability to discern fog relative to change (Panofsky and Brier, 1968). By allowing both the upper and lower cutoff count values to vary, a computer printout of a field of skill scores for the various count values then could be analyzed to determine the existence of relative skill score maxima.

For example, in Table II, if the lower SRIR-DAY value for fog was chosen to be 70 (horizontal scale), and the upper value was chosen to be 130 (vertical scale), with values < 70 and > 130 indicating clear, the resulting skill score

is .192. See Figure 13B. In Table II, only data from Categories 5 (heavy fog) and 9 (clear skies) are considered. In Table II, as well as the remaining skill score tables, the actual skill scores have been multiplied by 1000 for ease of analysis.

Skill scores may range from negative values to ± 1.0 with ± 1.0 indicating a perfect distinction between clear and fog reports while a score of 0.0 would imply no skill relative to chance. Negative skill values indicate chance performs better than the scheme specified here. In the discussions which follow, Category 6 was not used when relating fog to other categories due to probable contamination with higher level clouds.

a. SRIR-DAY Data

Table II presents skill values for Category 5 versus Category 9 reports with a "tongue" of relative maxima centered about the count value of 166 and a maximum skill score of .540. Similar results were obtained when all fog categories (1-5) were compared with the clear category (Table III), except count value 166 became a secondary maxima while count value 170 became the primary maxima, and the skill in general was lower by a scant .03. A portion of the dilution of skill may be attributed to the inclusion of the light fog categories. An analysis of stratus clouds versus clear (Table IV) indicates a less distinct boundary with maxima occurring in the upper value range of 158 to 170.

An attempt to ascertain the boundary between fog and stratus was made by contrasting Categories 5 and 8 (Table V). The boundaries are inconclusive, as seen in the table.

The real test of the IR sensor's ability to detect fog was found by considering all the fog reports (Categories 1-5) and those indicating no fog (Table VI). A primary horizontal axis of positive skill was shown along the upper value of 146 with several secondary maxima oriented along a vertical axis centered about the lower values of 70 to 72. As with Table V, skill is minimal.

When investigating fog occurrence over ocean areas, every attempt was made to extract information from the existing synoptic ship reports which would give an indication of fog presence. Therefore, it was reasonable to assume that a past-weather report of heavy fog (Category 7) might be a useful tool (in the absence of present-weather fog) when establishing fog boundaries. A report of past-weather fog indicates the horizontal visibility was reduced to less than 5/8 mi during the five-hour period one to six hours preceding the observation, due to heavy fog, haze, or smoke. Since haze and smoke are seldom observed to reduce horizontal visibility over the open ocean, the reduction in visibility was attributed to fog. Thus, it may be reasoned that, although fog was not observed at the time of the synoptic report, the ship was likely to have been located near the fog boundary and perhaps Category 7 should be

included with the fog categories (1-5). However, when Categories 1-5 were compared with Category 7 (Table VII), a relatively skill maxima was found near the upper count value of 162, implying a reasonable distinction existed between present-weather fog and past-weather fog. Similar results were obtained when comparing Category 7 with stratus (Table VIII). The fact that the axis of the skill score maxima were oriented along an upper count value would indicate that a past-weather fog report with no present-weather fog exhibited a tendency toward higher SRIR-DAY count values or the clear area. Compare Table VIII to Table V. Although the sample size for Category 7 was relatively small (103 reports), its inclusion with present-weather fog reports was not recommended at this time based on the above results.

b. SRVIS Data

Comparisons, similar to those described for SRIR-DAY, were also conducted using SRVIS data. Table IX shows that the largest distinction between heavy fog and clear occurs close to count value 54, but with the axis of maxima values quite broad. When all fog categories (1-5) were contrasted with clear reports, the axis of the relatively broad maxima "tongue" shifted slightly toward the clear area to a count value of 52 to 54 (Table X). This shift would be expected if the visual sensor "looked through" some of the light fog being reported, yielding count values similar to those found in clear areas. Table XI depicted an indistinct boundary between stratus and clear

occurring near count value 52 and secondary protrusions were noted at count values 46 and 66.

An effort to discern a boundary between fog and stratus, using Table XII, indicated only a very small positive skill (maximums .048) was present with a vertical axis of maxima centered around the lower count value of 56. A primary horizontal axis of maxima skill score was found near the upper count value 154. The contrast between all fog (Categories 1-5) and stratus (Table XIII) also indicated a vertical axis of maxima along upper count value 56 with maxima in the horizontal along lower count value 154.

When skill scores for fog (1-5) versus no fog were analyzed (Table XIV), the distinctions observed were quite subtle. Weak maxima in the vertical were observed between the lower count values of 56 to 66. However, the variations in the horizontal were broad with weak fluctuations occurring from the upper count values of 146 to 168 and from 174 to 218.

Tables XV and XVI indicated the existence of a very weak distinction between past-weather fog (Category 7) and present-weather fog and stratus as discussed using SRIR-DAY data.

3. VIF Diagram

In pursuing still another approach to depict boundaries between either fog and clear skies or fog and stratus or higher clouds, a three-dimensional diagram was devised showing relationships between visual data, infrared data, and frequency of occurrence (VIF diagram). The VIF

diagram (see Table XVII) has been divided into a grid of squares with each square representing 10 SRIR-DAY count values and 10 SRVIS count values. The scale of SRIR-DAY count values is shown along the top of the diagram with SRVIS count values along the left margin. Two values were plotted within each square which represent the total ship reports contained within the combined SRIR-DAY and SRVIS count values of that square (lower value) and the percentage of the total reports within the square which fell within the category or categories being investigated (upper value). For example, in Table XVII, it is found that 51 of the reports in this study had SRIR-DAY count values between 160 and 169 inclusively and SRVIS count values between 20 and 29 inclusively. Also, 11% of these 51 reports were within Category 9 (i.e. clear reports). The right-hand side of the diagram displays the number of clear and total reports, and the percentage of clear reports for each row. A similar tabulation is given along the bottom of the diagram for each column. The distribution of clear and total reports can be determined through an analysis of the VIF diagram; such information then can be used in selecting cutoff count values for the combined SRIR-DAY and SRVIS data. Also, skill scores can be calculated for various cutoff count values to aid in obtaining an optimum combination of SRIR-DAY and SRVIS count values.

For example, if all ship reports within the SRVIS range of 0 through 49 and within the SRIR-DAY range of 170 through 199 (shaded region of Table XVII) were diagnosed as

clear reports, the skill score would be .217, associated with 47% of the total clear reports in the shaded area. This skill score can be compared with skill scores obtained using SRIR-DAY and SRVIS individually for Category 9 versus total reports. The results are shown in Tables XIX and XX which indicate a maximum skill of .216 for SRIR-DAY only and .179 for SRVIS only. Thus the combined efforts of SRIR-DAY and SRVIS data indicated no improvement over using SRIR-DAY count values alone to distinguish clear areas. When heavy fog reports (Category 5) were contrasted with all remaining non-fog reports (i.e. Categories 1-4 and 6 were removed from the sample), the resulting distribution on the VIF diagram was more complex (see Table XVIII). If the shaded composite of SRIR-DAY and SRVIS values in Table XVIII were used to diagnose heavy fog, the resulting skill score would be .06.

I. ANALYSES OF SRIR-DAY AND SRVIS COUNT VALUES

Analyses of the NOAA-2 data utilizing the routine "CONTUR," as previously discussed, was accomplished for most of the study period. Figures 15 and 17 depict analyses of July 1, 1973, NOAA-2 digital data using selected cutoff count values. Figure 15 is an analysis of the SRIR-DAY imagery shown in Figure 14 and used the count value of 168 to distinguish between clear areas and potential fog areas. Count value 145 was used to segregate the higher level clouds from the potential fog area. Count value 125 was utilized to depict the boundary of frontal-type clouds.

Similarly, Figure 17, an analysis of the SRVIS imagery in Figure 16, utilized count value 58 for the clear/potential fog boundary, count value 150 for the potential fog/higher cloud boundary, and count value 165 to depict frontal-type clouds. It should be noted that fog existed below the frontal-type clouds, but the limitations of the satellite data discussed earlier in "seeing through" higher clouds precluded detection of fog within this region using satellite data only.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The objective of this study was to develop a procedure for utilizing meteorological satellite data to diagnose marine fog over the open ocean. This objective was accomplished by merging conventional ship reports with the NOAA-2 digital satellite data and applying three methods (discussed in Section IV. H) to determine cutoff count values of both SRIR-DAY and SRVIS data.

The use of histograms denoted the frequency distribution of SRIR-DAY and SRVIS data over the domain of count values (0-254) for all the ship reports involved in this study, but, at best, could only be utilized to obtain relatively broad cutoff values.

Analyses of skill scores, obtained by means of contrasting various category combinations, resulted in relative maxima of skill scores, which were interpreted to portray regions of optimum distinction between the contrasting categories. The use of skill scores relative to chance when investigating fog may be questioned as a suitable comparator since the formation of fog was not a completely random process in this study as revealed by the existence of 740 fog reports compared to 2516 non-fog reports. It is believed that skill scores, utilizing the non-random nature of fog, as a basis, would be primarily reflected in the magnitude of the skill scores

(probably lower) but would not have a significant effect on the relative distribution of the skill scores.

The VIF diagram was a convenient method for displaying the distribution of the ship reports relative to both the SRIR-DAY and SRVIS count values. It indicated that the ship reports were not uniformly distributed throughout the field of count values. Preferred areas of concentration were noted for various categories. By applying various "cutoff" combinations within these preferred areas for fog and computing the resulting skill scores, regions could be selected which would optimize the distinction between fog and no fog, thus facilitating the depiction of fog boundaries. The utility of the VIF diagrams could be greatly enhanced by significantly increasing the data base from which the diagrams were derived.

From the processing completed in this study, the cutoff count values for fog were subjectively determined to be as follows:

SRIR-DAY:

- lower cutoff boundary between fog and higher clouds: 142-146
- upper cutoff boundary between fog and clear: 166-170

SRVIS:

- lower cutoff boundary between fog and clear: 54-60
- upper cutoff boundary between fog and higher clouds: 148-154

The approaches using skill-score analyses and VIF diagrams showed the capability of positive skill in diagnosing marine fog. Although the use of satellite data alone is not sufficient to adequately depict marine fog boundaries, it is believed that when the digital satellite data are utilized in conjunction with other meteorological parameters such as wind, temperature, etc., the satellite becomes an essential tool in improving marine-fog analyses over the open ocean.

Results observed in this study indicated the SRIR-DAY data alone performed as well as the combined effects of SRIR-DAY and SRVIS data. Thus the incorporation of SRVIS data did not appear to justify the additional computer requirements for processing. However, further investigations into the necessity of visual data in diagnosing marine fog are required before this observation can be substantiated.

The final phase anticipated for this study was to verify plotted "ground-truth" ship reports for each day of the study period utilizing the analyzed potential fog areas depicted above to determine the regional degree of skill involved in diagnosing fog from these cutoff count values. However, time limitations precluded incorporation of this final phase into the study. The completion of this verification phase is believed a requisite for future studies of marine fog diagnosis using digitized satellite data.

B. RECOMMENDATIONS

The following recommendations are offered for future studies:

1) Expand a similar study to a significantly larger data base which would permit further refinement of the fog categories, to include wind and temperature variations.

2) Incorporate SRIR-NIGHT data into future studies and determine the latitudinal variation, if any, in the infrared count values so that corrections may be made to existing data to eliminate such variations.

3) Perform an investigation to determine whether the addition of visual count values enhance the capability of diagnosing marine fog in a scheme involving infrared count value only.

4) Perform a complete verification of fog areas analyzed by the "CONTUR" or similar analysis scheme, using conventional ship reports as "ground-truth."

5) Explore the possibility of assigning "weighting" factors to selected visual/IR count-value combinations utilizing climatology, moisture content, wind, temperature, and other fog-related parameters to arrive at a credible fog probability analysis which has operational utility and can be used as an improved data base for fog forecasting.

6) Investigate the feasibility of using a geo-stationary, vice polar orbiting, satellite to obtain the visual and infrared data in future studies to alleviate the time-compatibility problem. If these data are obtained from a satellite positioned over the equator, such as in the GOES series, it will be necessary to determine if any distortion exists due to the inclination angle of the satellite view in the fog regions (40-60N).

7) Investigate the use of the analysis of cutoff count values of digital satellite data to depict frontal systems, extratropical and tropical storms, potential fog areas, and clear areas which information then can be transmitted to surface ships lacking satellite receiving capabilities via the fleet broadcast in lieu of satellite imagery mosaics. It is believed this type of display of major satellite features could be a significant improvement over visual interpretation of gray shades from satellite imagery facsimile.

APPENDIX A

TRIGONOMETRIC RELATIONSHIPS USED TO DEVELOP "EARTH-LOCATION" PROGRAM

Given: Latitude and longitude of Point B in Figure 18

Find: Grid distances HB and JB on 320 x 868 sub-grid array (Figure 18B) which locate Point B

Method:

(1) Determine distance AB in Figure 18A.

β = latitude of Point B

AD = 998.54 = CONSTANT

$\Phi = 90 - \beta$

ANGLE ADB $= \frac{\Phi}{2}$

$AB = AD(\tan(\frac{\Phi}{2}))$

In Figure 18A, line $E_1 F_1$ lies in plane EF and intersects the surface at the earth at 60N. AD is a segment of the line passing through the north and south poles (north pole at top of diagram). Figure 18B is a view of the plane EF as seen from the north pole looking toward the center of the earth. AB in Figure 18B corresponds to AB in Figure 18A.

(2) LONG = LONGITUDE of Point B (in radians)

α = LONG - 10 (note: 10 is subtracted from the longitude because α is measured from 10E)

$\theta = 180 - \alpha$

$GA = AB \cos\theta$

$BG = AB \sin\theta$

$HB = (417 - BG) + 1.5$ (note: 1.5 is correction

$JB = (585 - GA) + 1.5$ suggested by the Satellite Department at EPRF to account for the transfer of geographic locations to repeat nearest grid point in the 2048 x 2048 array)

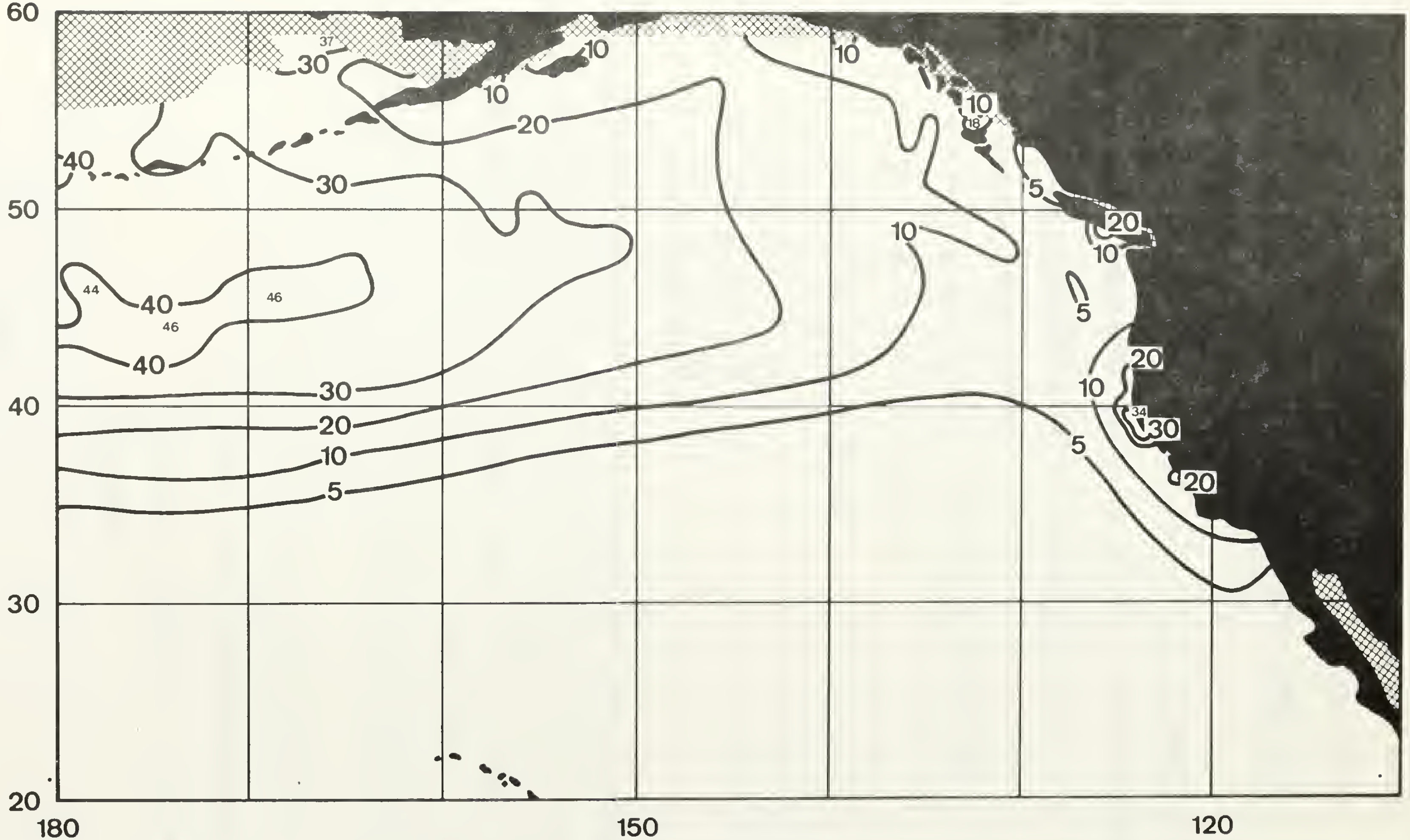


Figure 1. July Climatological Marine-Fog Frequencies (%), Eastern North Pacific Ocean (Willms, 1975)

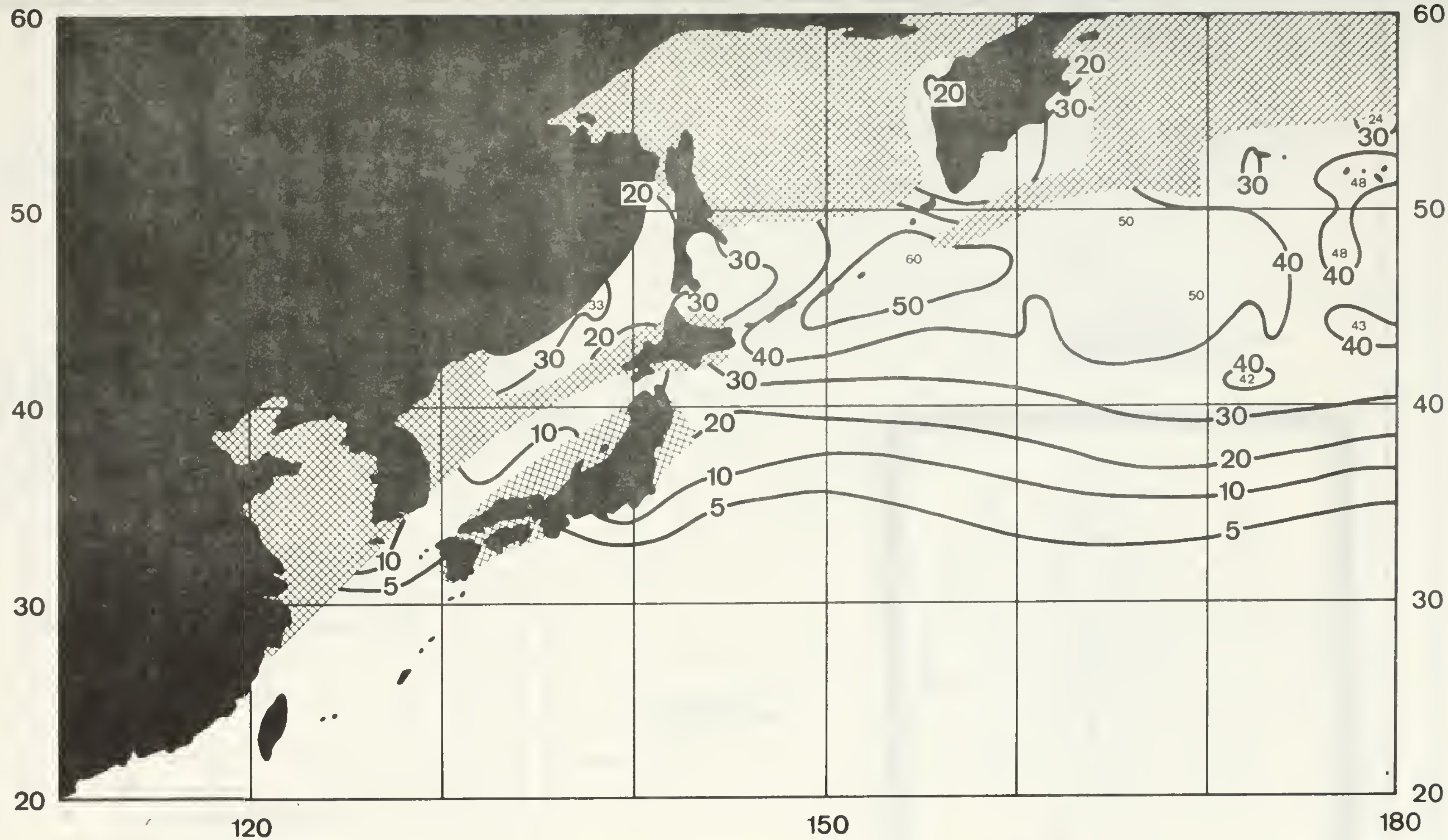


Figure 2. July Climatological Marine-Fog Frequencies (%), Western North Pacific Ocean (Willms, 1975)

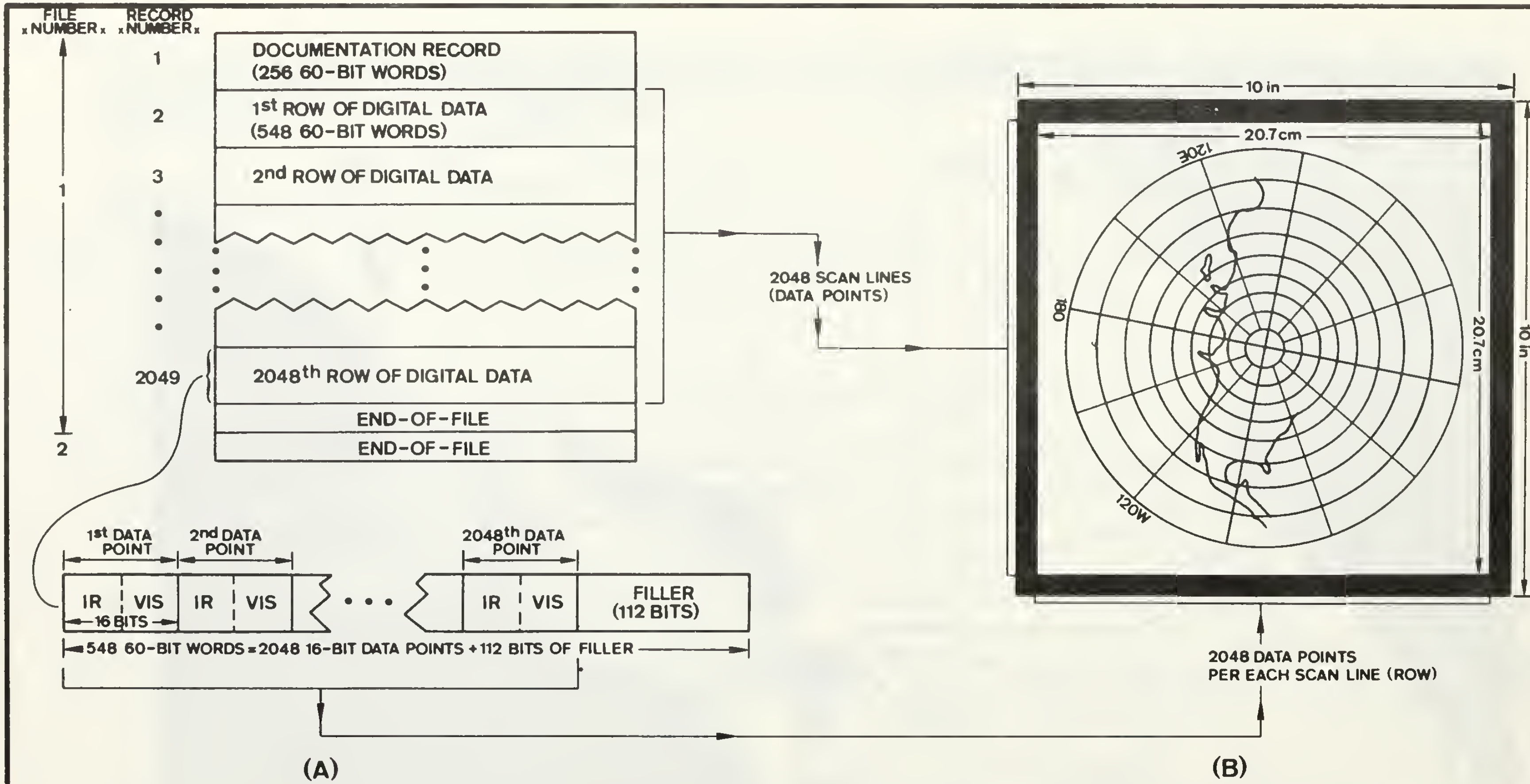
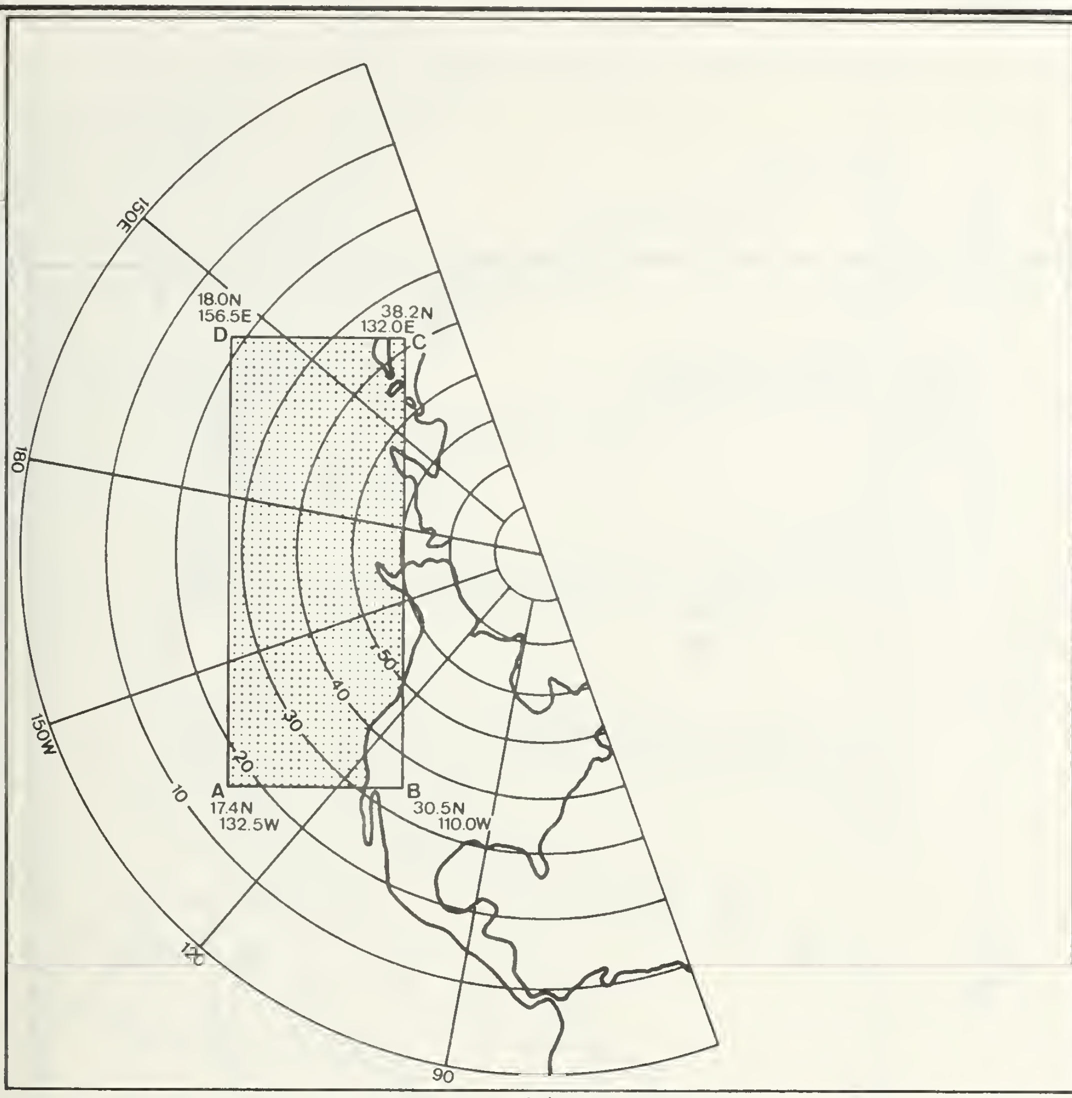
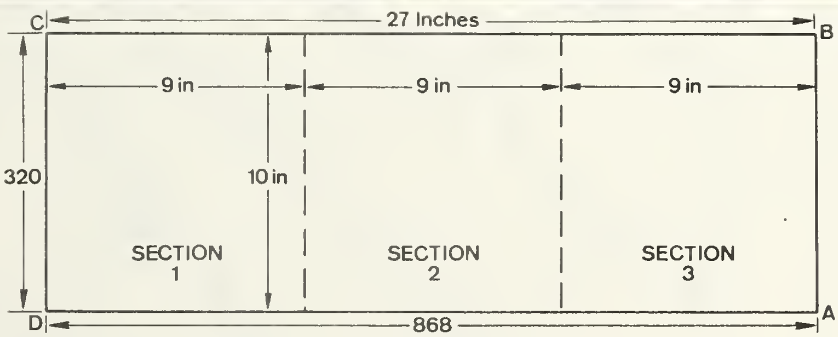


Figure 3A. Digital Tape Format for Northern Hemisphere NOAA-2 SRIR-DAY and SRVIS Data

Figure 3B. Digitally-Composited Mosaic Format for Northern Hemisphere NOAA-2 SRIR-DAY and SRVIS Data



(A)



(B)

Figure 4A. Background for Digitally Composited NOAA-2 Mosaic Showing North Pacifc Ocean Study Area (Shaded)

Figure 4B. Sub-grid Area Showing Dimensions of Sections Used for "CONTUR" Output

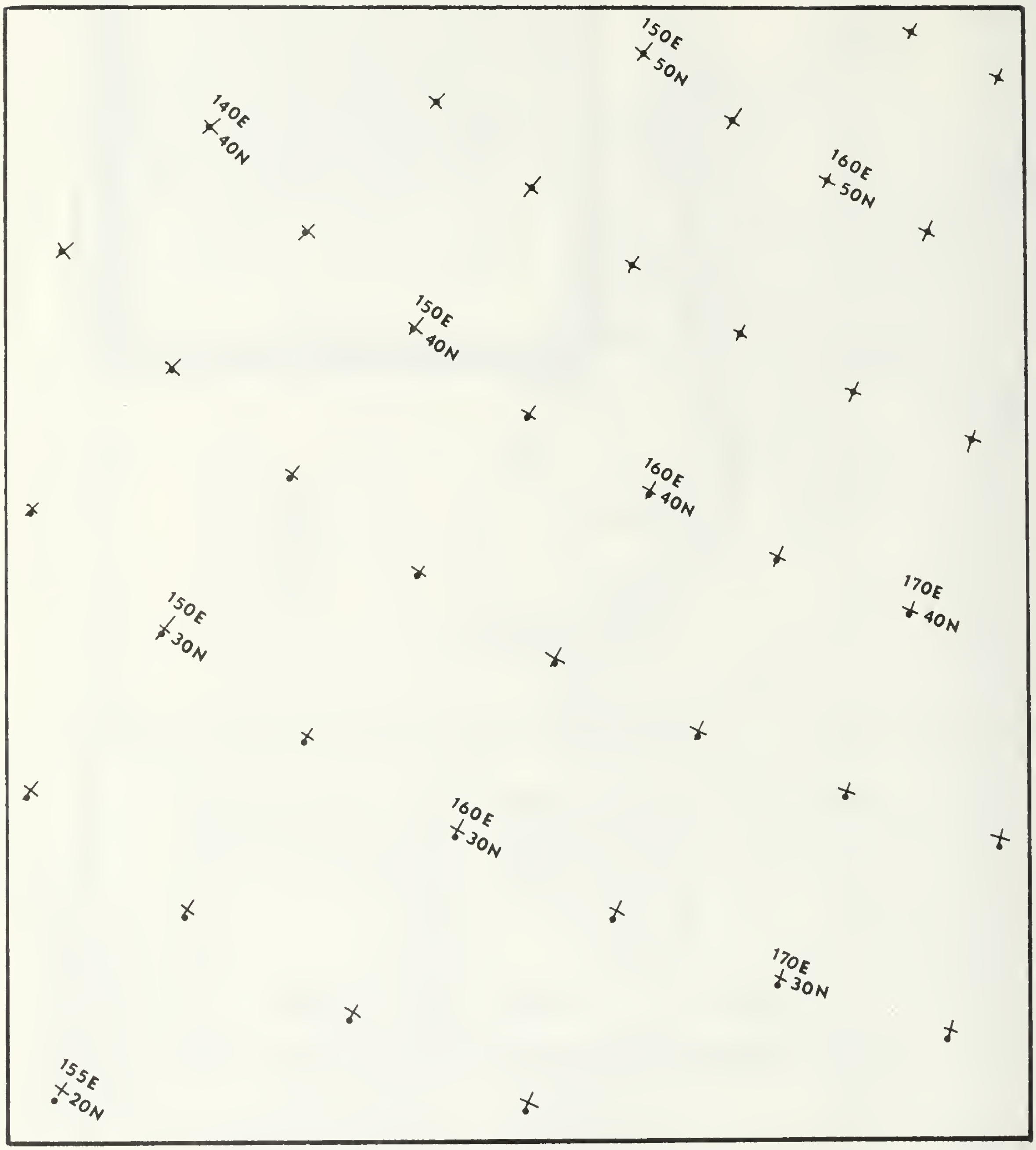


Figure 5. Comparison Between Selected "Earth-Located" Positions (Dots) and Corresponding Geographical Positions (Crosses)

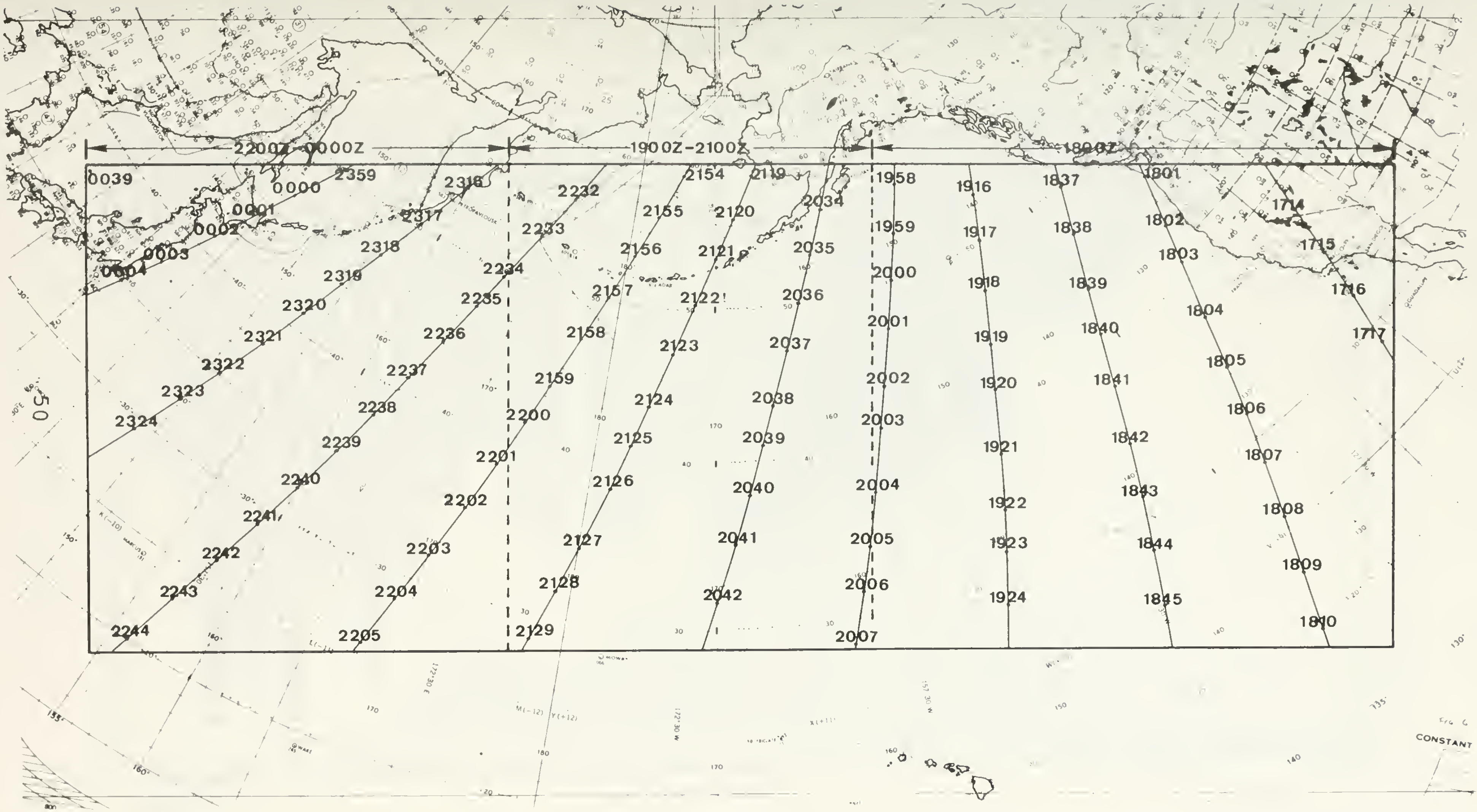


Figure 6. Plot of Selected NOAA-2 Orbit Paths Within Study Area Showing Hoursand Minutes (GMT) at One-Minute Intervals Along Each Orbit

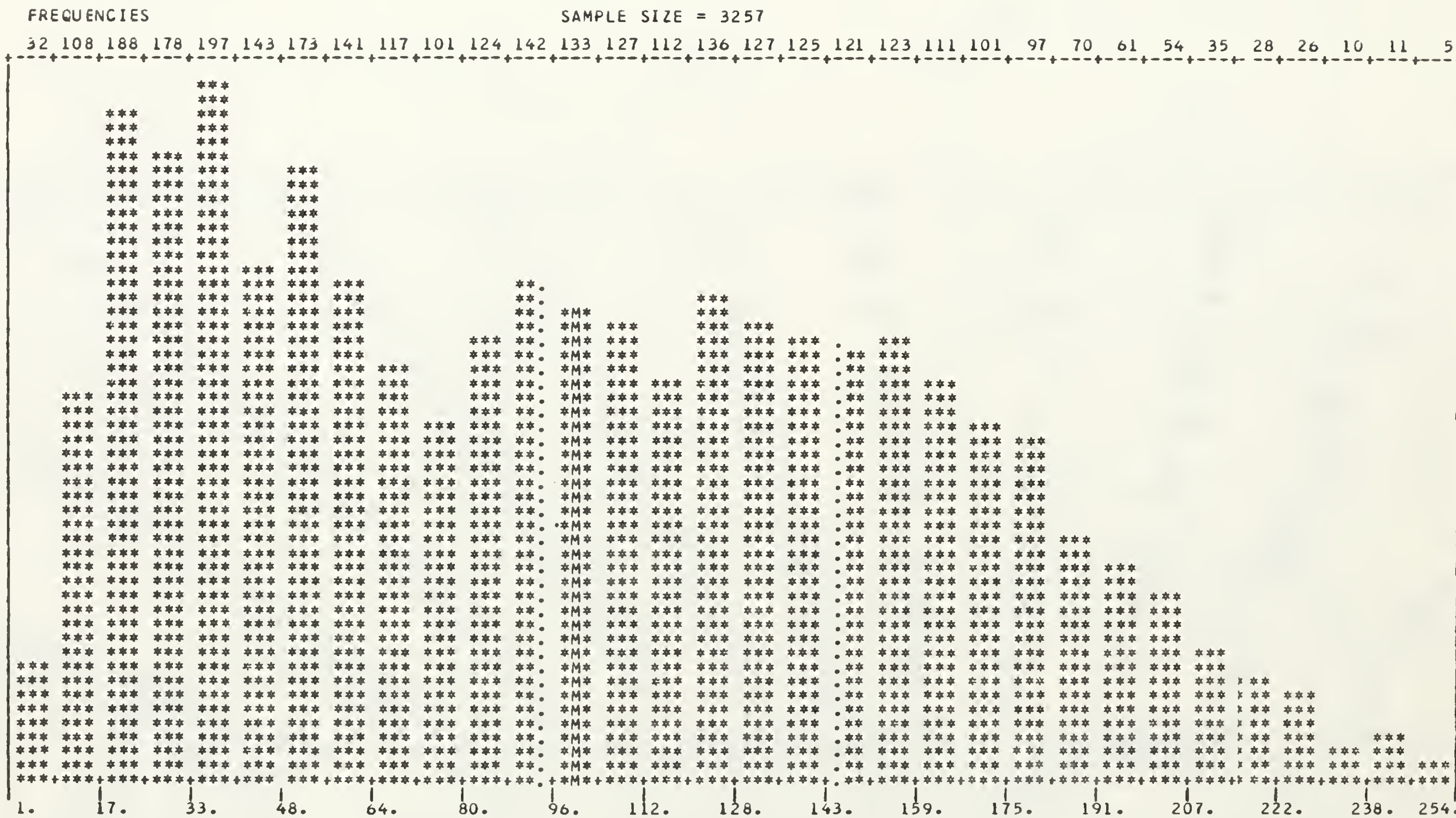

FREQUENCIES
SAMPLE SIZE = 3257
32 108 188 178 197 143 173 141 117 101 124 142 133 127 112 136 127 125 121 123 111 101 97 70 61 54 35 28 26 10 11 5
1. 17. 33. 48. 64. 80. 96. 112. 128. 143. 159. 175. 191. 207. 222. 238. 254.

Figure 7A

Figure 7B

Histograms of (A) SRVIS and (B) SRIR-DAY Count Values for Total Reports Processed in Study

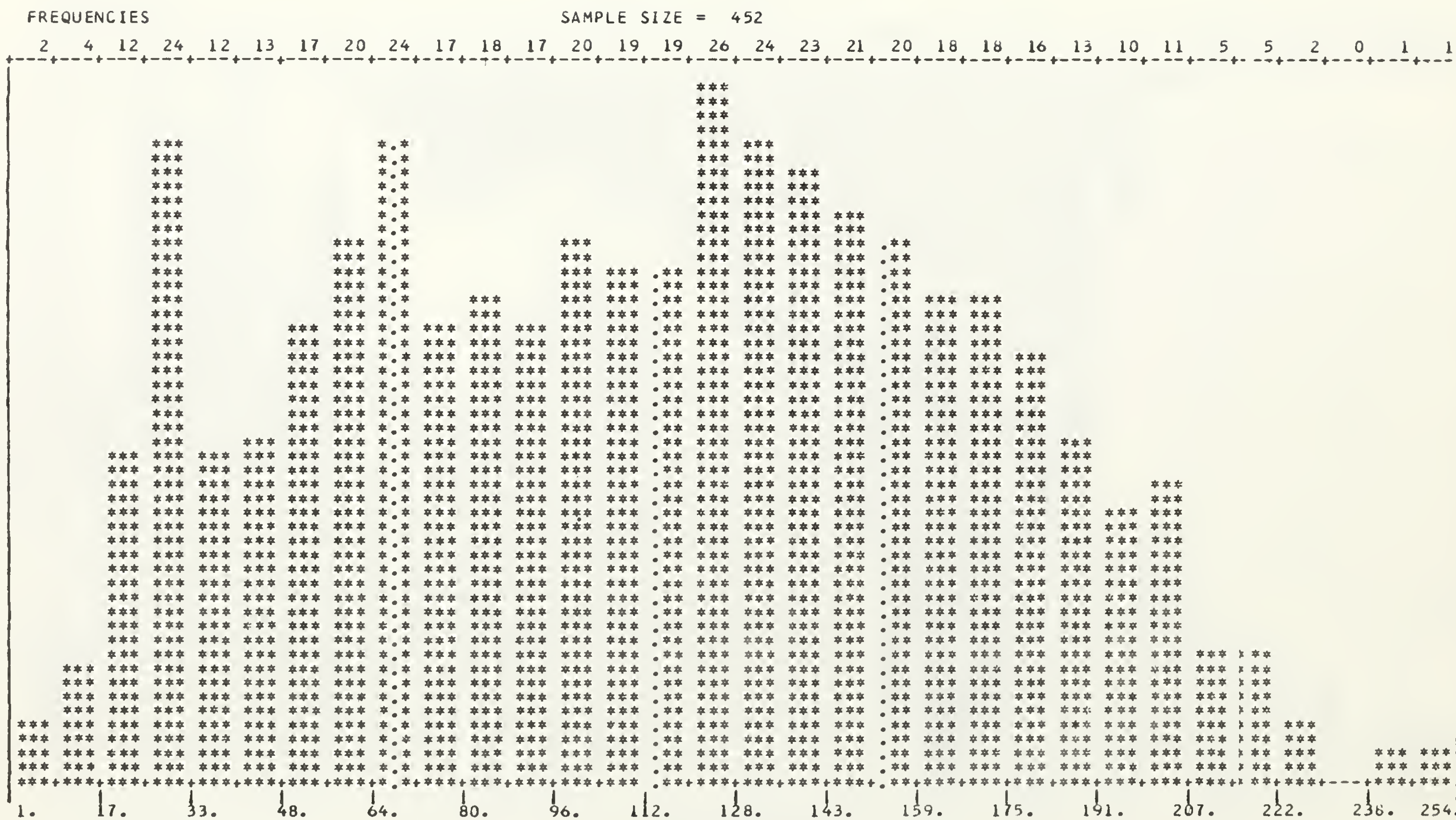

FREQUENCIES
SAMPLE SIZE = 452
2 4 12 24 12 13 17 20 24 17 18 17 20 19 19 26 24 23 21 20 18 18 16 13 10 11 5 5 2 0 1 1
1. 17. 33. 48. 64. 80. 96. 112. 128. 143. 159. 175. 191. 207. 222. 238. 254.

Figure 8A

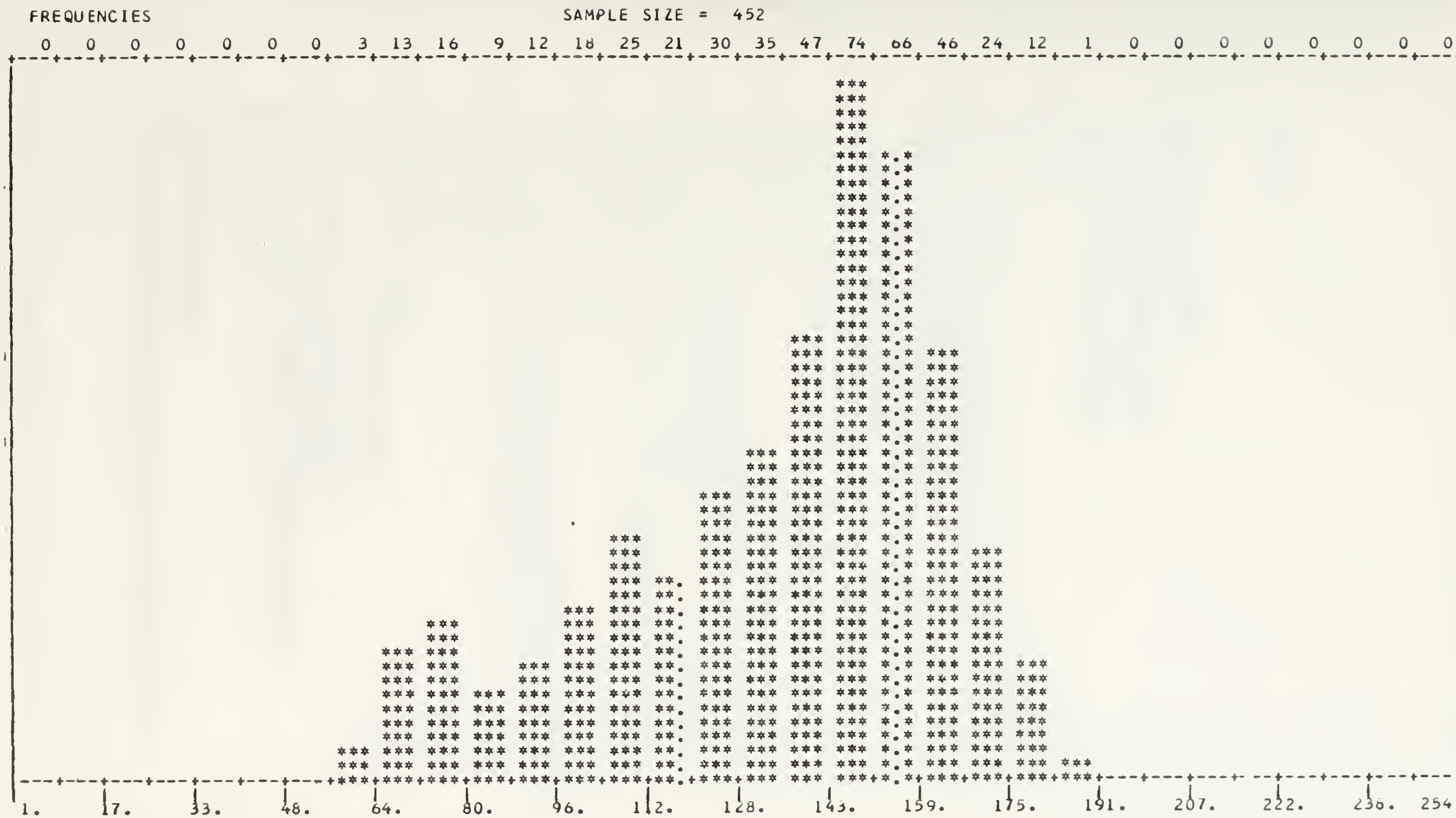


Figure 8B

Histograms of (A) SRVIS and (B) SRIR-DAY Count Values for Category 5 (Heavy Fog) Reports Processed in Study

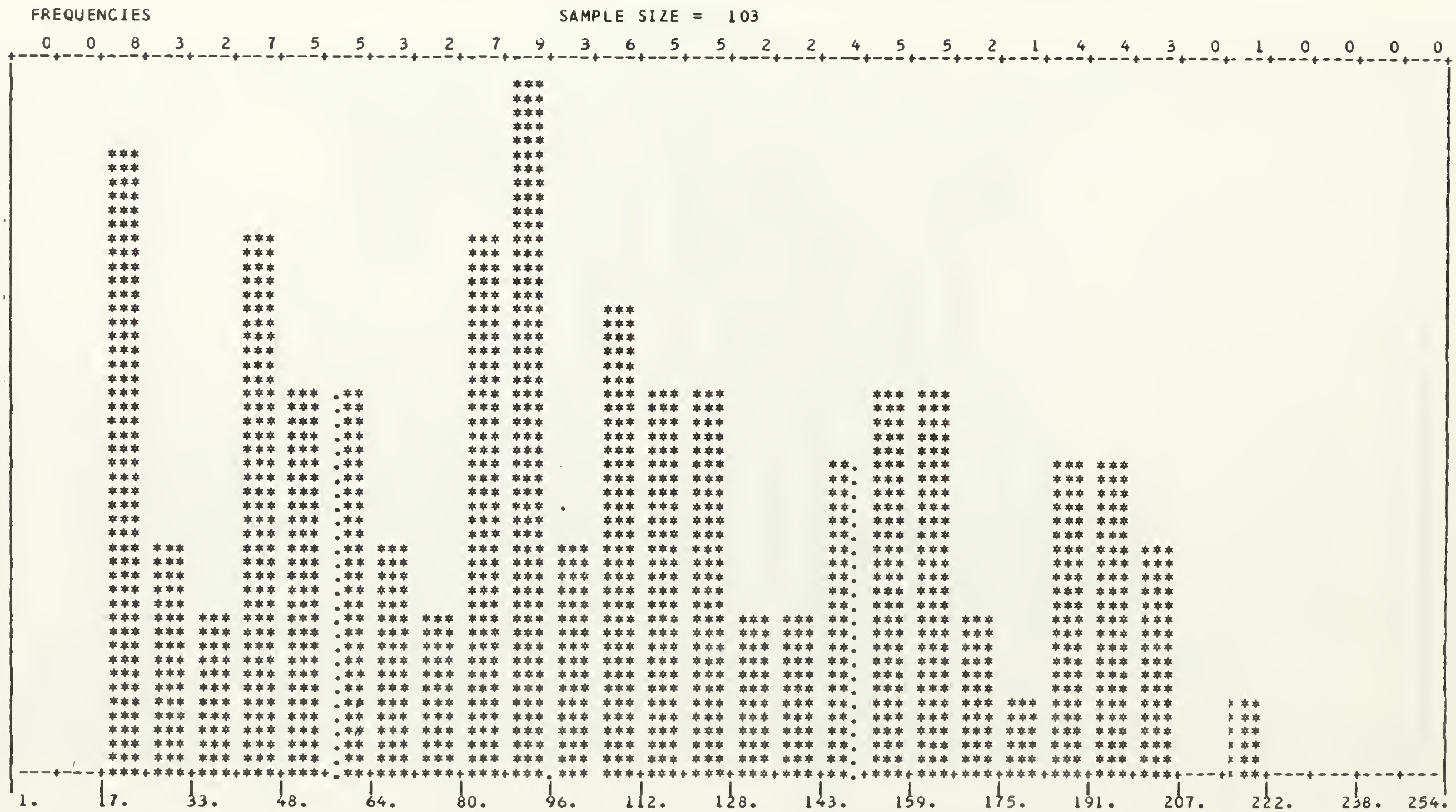

FREQUENCIES
SAMPLE SIZE = 103
0 0 8 3 2 7 5 5 3 2 7 9 3 6 5 5 2 2 4 5 5 2 1 4 4 3 0 1 0 0 0 0
1. 17. 33. 48. 64. 80. 96. 112. 128. 143. 159. 175. 191. 207. 222. 238. 254.

Figure 9A

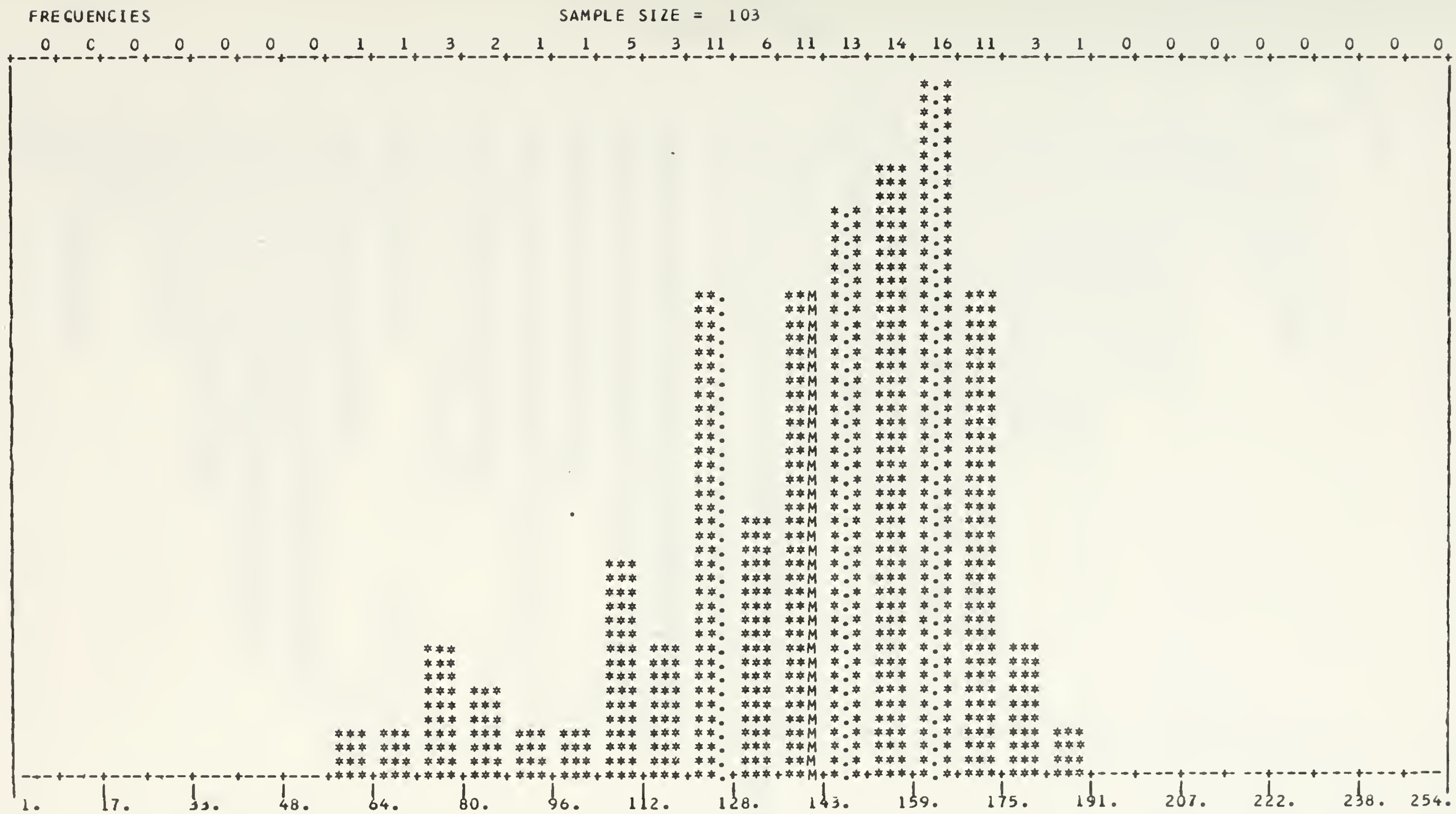


Figure 9B

Histograms of (A) SRVIS and (B) SRIR-DAY Count Values for Category 7 (Past-Weather Fog) Reports Processed in Study

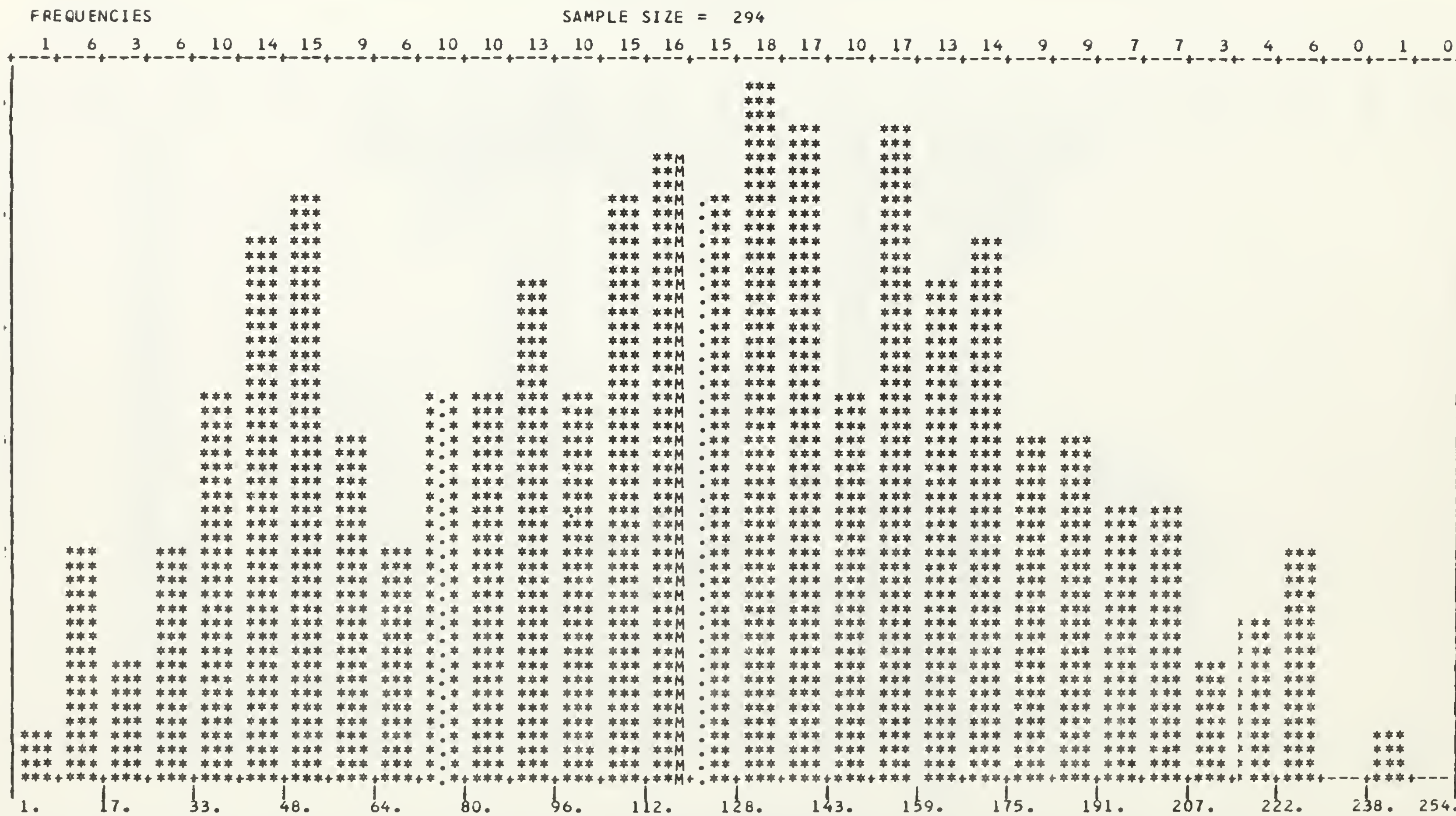

FREQUENCIES
SAMPLE SIZE = 294
1 6 3 6 10 14 15 9 6 10 10 13 10 15 16 15 18 17 10 17 13 14 9 9 7 7 3 4 6 0 1 0
1. 17. 33. 48. 64. 80. 96. 112. 128. 143. 159. 175. 191. 207. 222. 238. 254.

Figure 10A

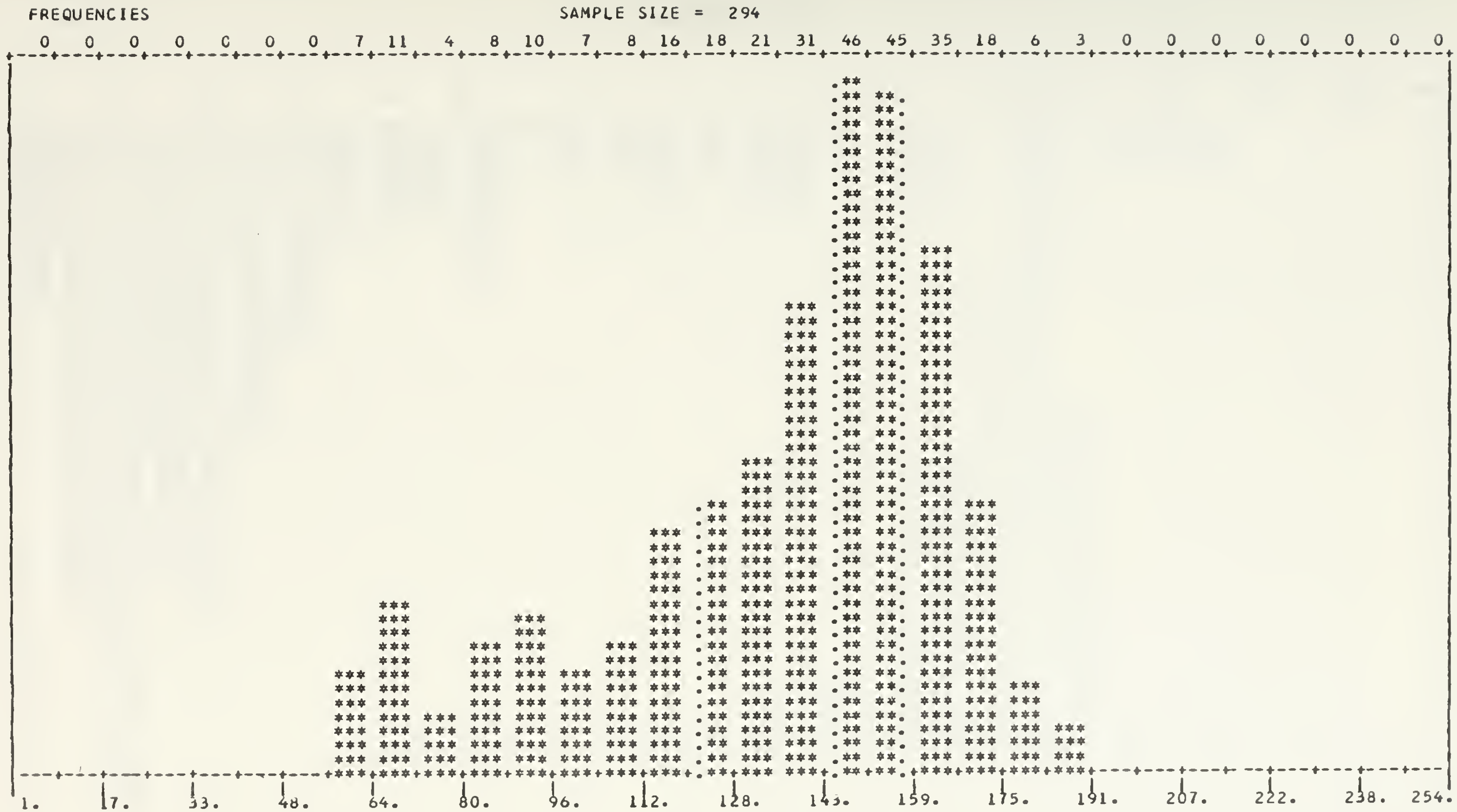


Figure 10B

Histograms of (A) SRVIS and (B) SRIR-DAY Count Values for Category 8 (Stratus) Reports Processed in Study

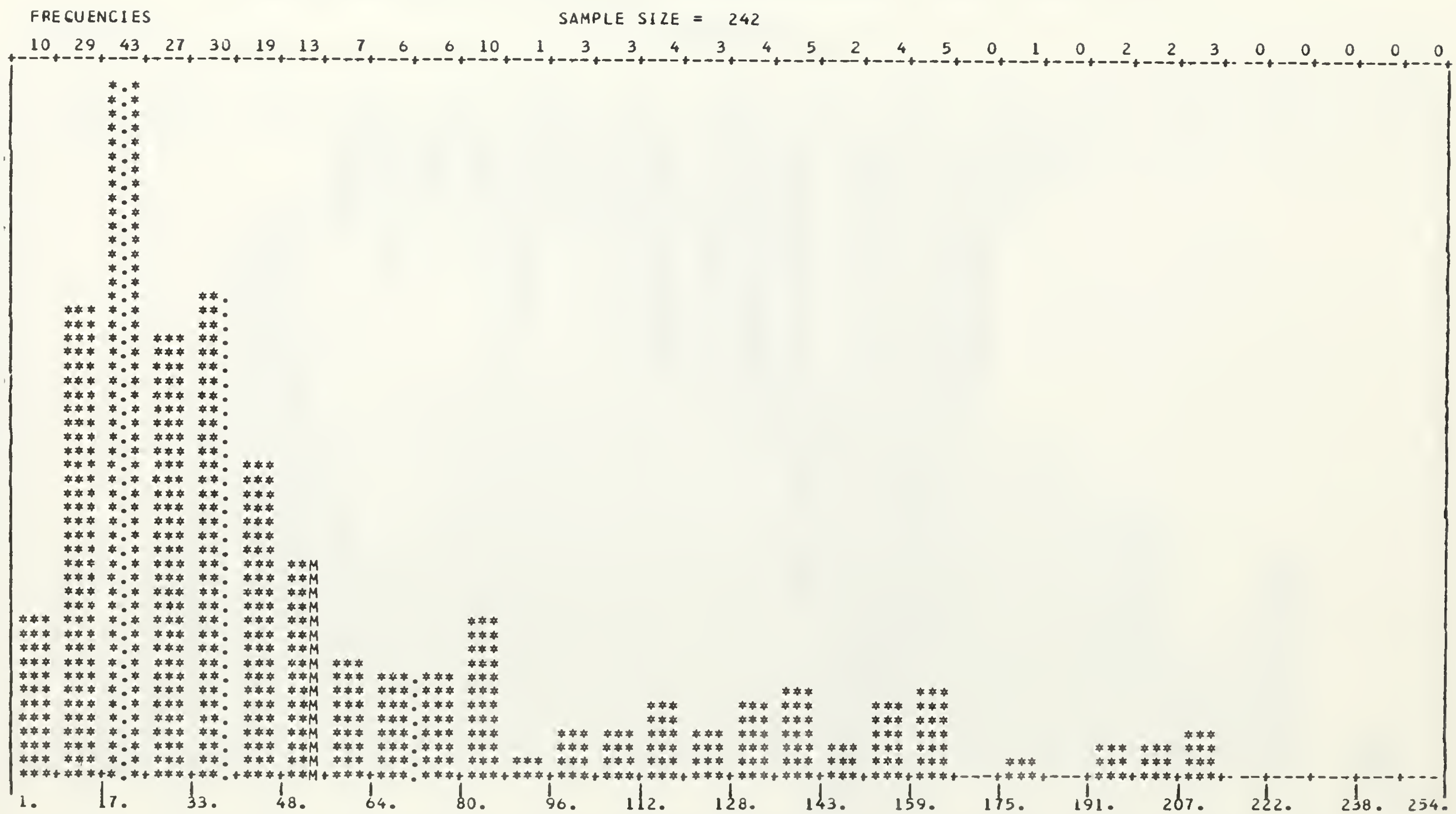

FRECUENCIES
SAMPLE SIZE = 242
10 29 43 27 30 19 13 7 6 6 10 1 3 3 4 3 4 5 2 4 5 0 1 0 2 2 3 0 0 0 0 0
1. 17. 33. 48. 64. 80. 96. 112. 128. 143. 159. 175. 191. 207. 222. 238. 254.

Figure 11A

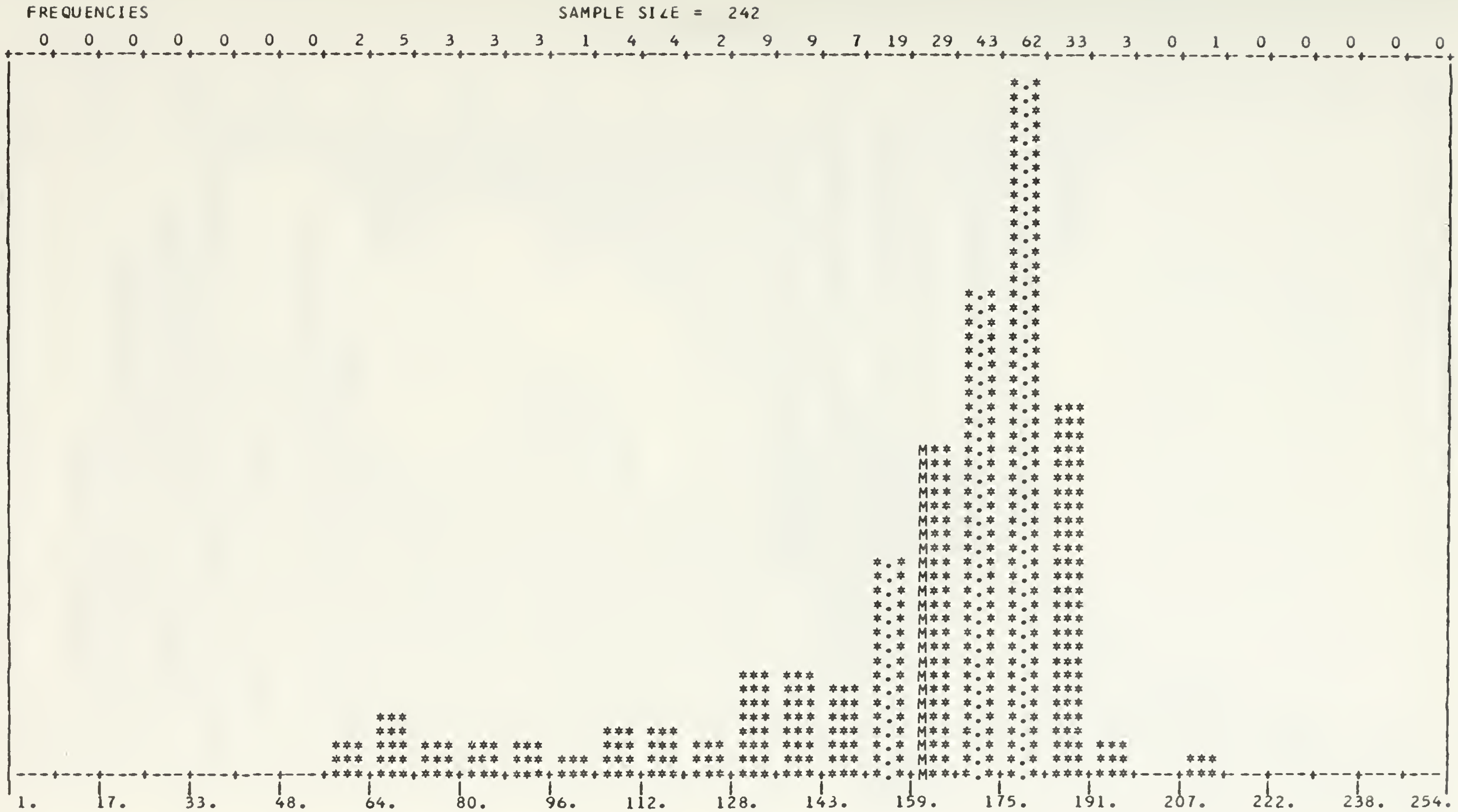


Figure 11B

Histograms of (A) SRVIS and (B) SRIR-DAY Count Values for Category 9 (Clear) Reports Processed in Study


FREQUENCIES
SAMPLE SIZE = 1877
0 0 0 0 0 4 10 21 44 36 27 35 53 49 66 95 111 170 241 271 261 171 154 54 4 0 0 0 0 0 0
1. 17. 33. 48. 64. 80. 96. 112. 128. 143. 159. 175. 191. 207. 222. 238. 254.

Figure 12A

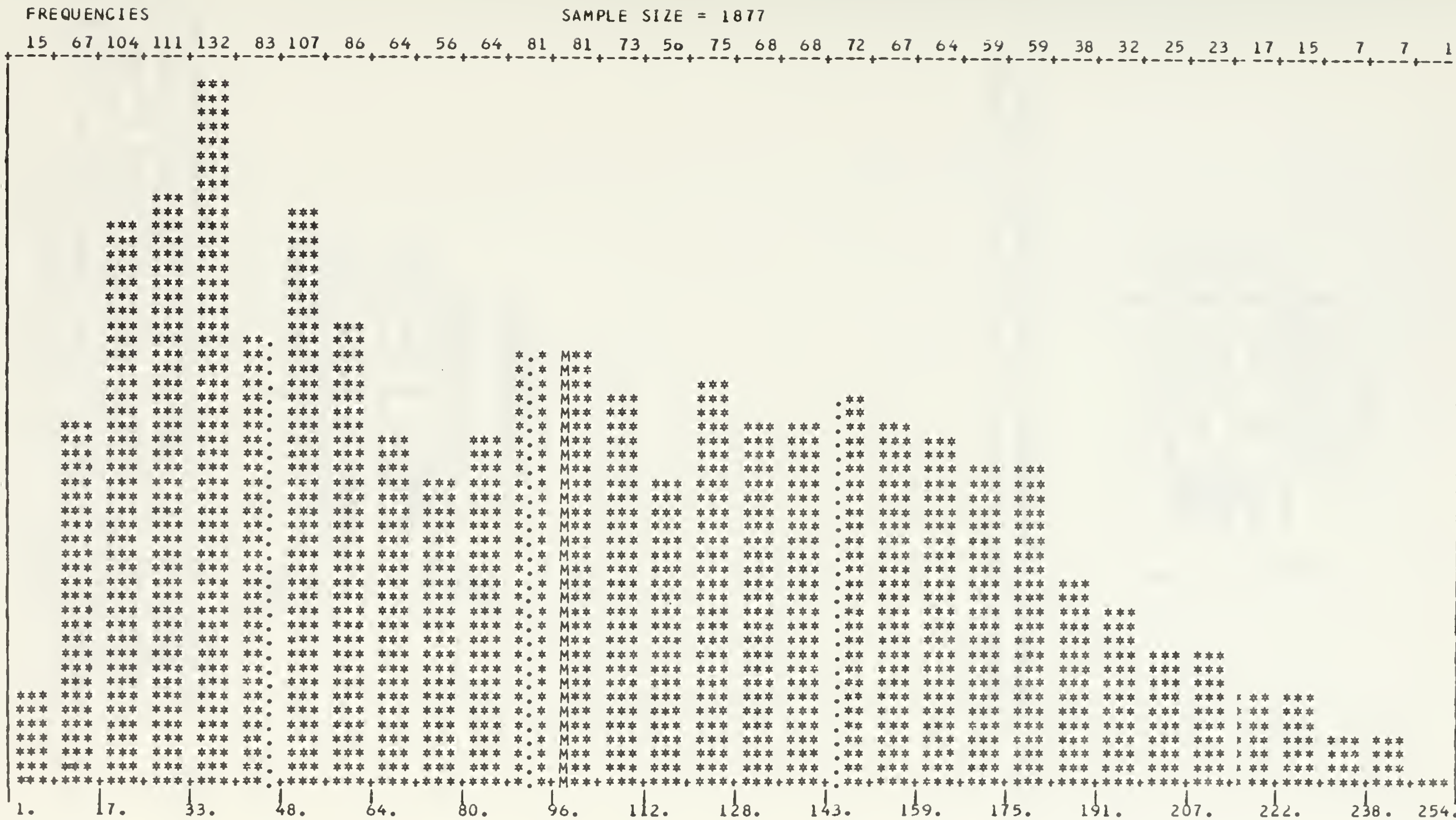


Figure 12B

Histograms of (A) SRVIS and (B) SRIR-DAY Count Values for
Category 0 (Total Reports Minus Categories 1-10) Reports Processed in Study

VERIFIED \ DIAGNOSED	FOG	NO FOG	
FOG	H_1	M_1	R_1
NO FOG	M_2	H_2	R_2
	C_1	C_2	T

Figure 13A. General Contingency Table Format Used to Compute Skill Scores Relative to Chance

VERIFIED \ DIAGNOSED	FOG	CLEAR	
FOG	153	299	452
CLEAR	23	219	242
	176	518	694

Figure 13B. Example of Contingency Table Data Used to Compute Skill Score for the Case of Discriminating Heavy Fog (Category 5) from Clear Skies (Category 9) as a Function of SRIR-DAY Count Values. Heavy Fog Specified for Count Values 70-130; Skill Score = .192 (See Table II).

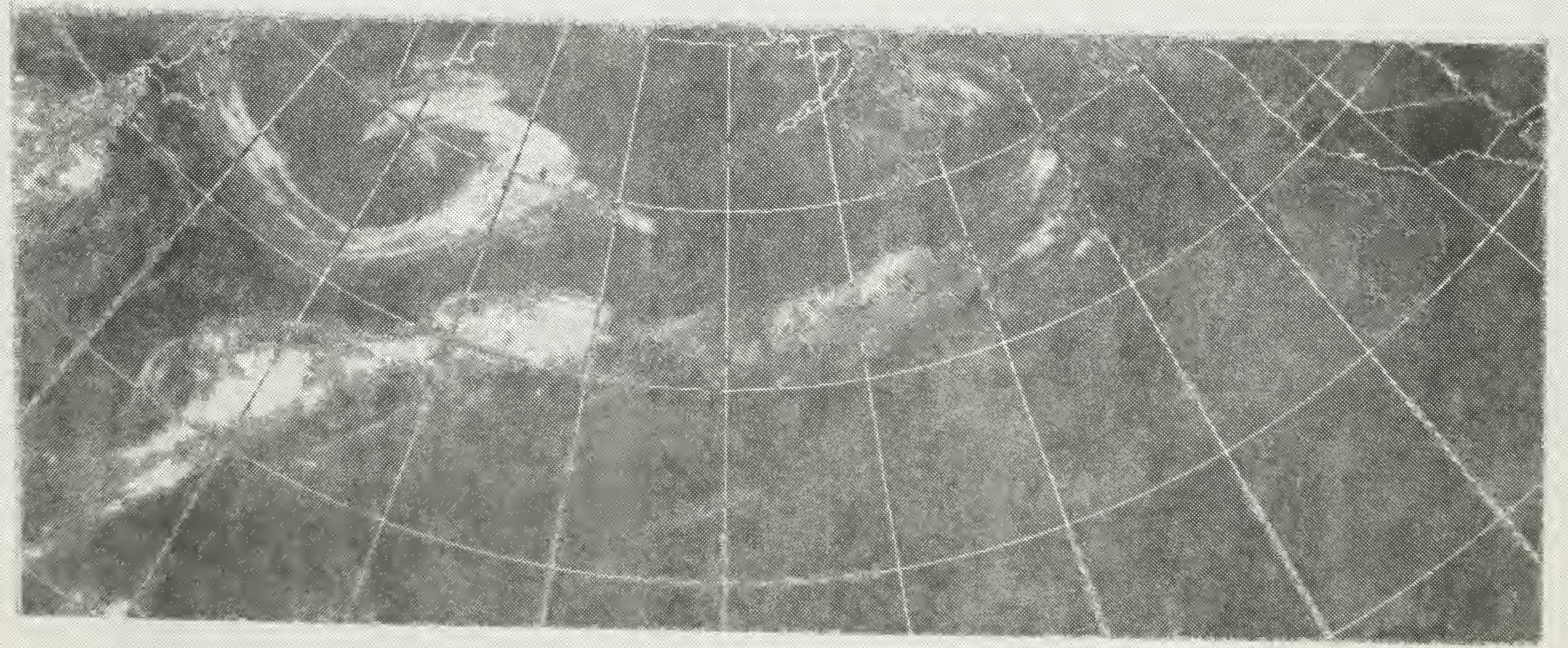


Figure 14. Digitally Composited NOAA-2 Mosaic of SRIR-DAY Data for 1 July 1973 Within Study Area

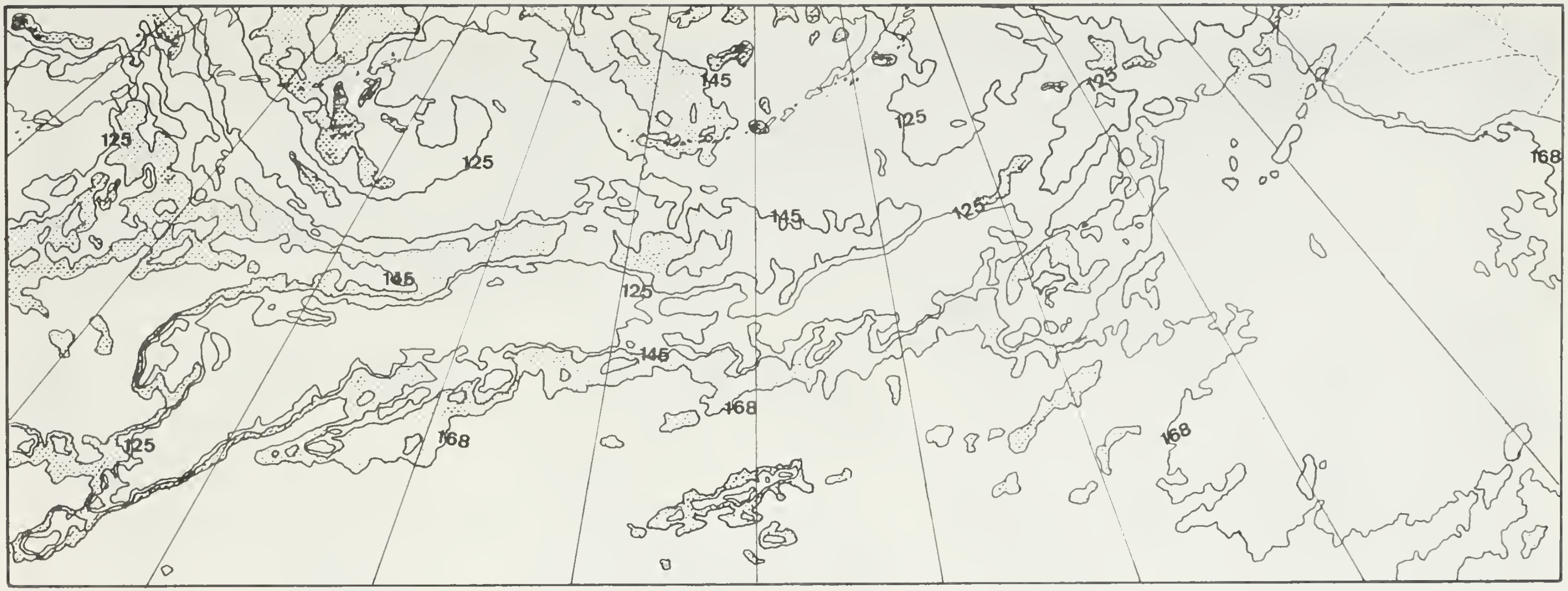


Figure 15. Analysis of Selected SRIR-DAY Digital Count Values (i.e. 125, 145 and 168) for 1 July 1973 Within Study Area. The Shaded Portion Represents Potential Areas of Fog Not Obscured by Middle- or High-Level Clouds

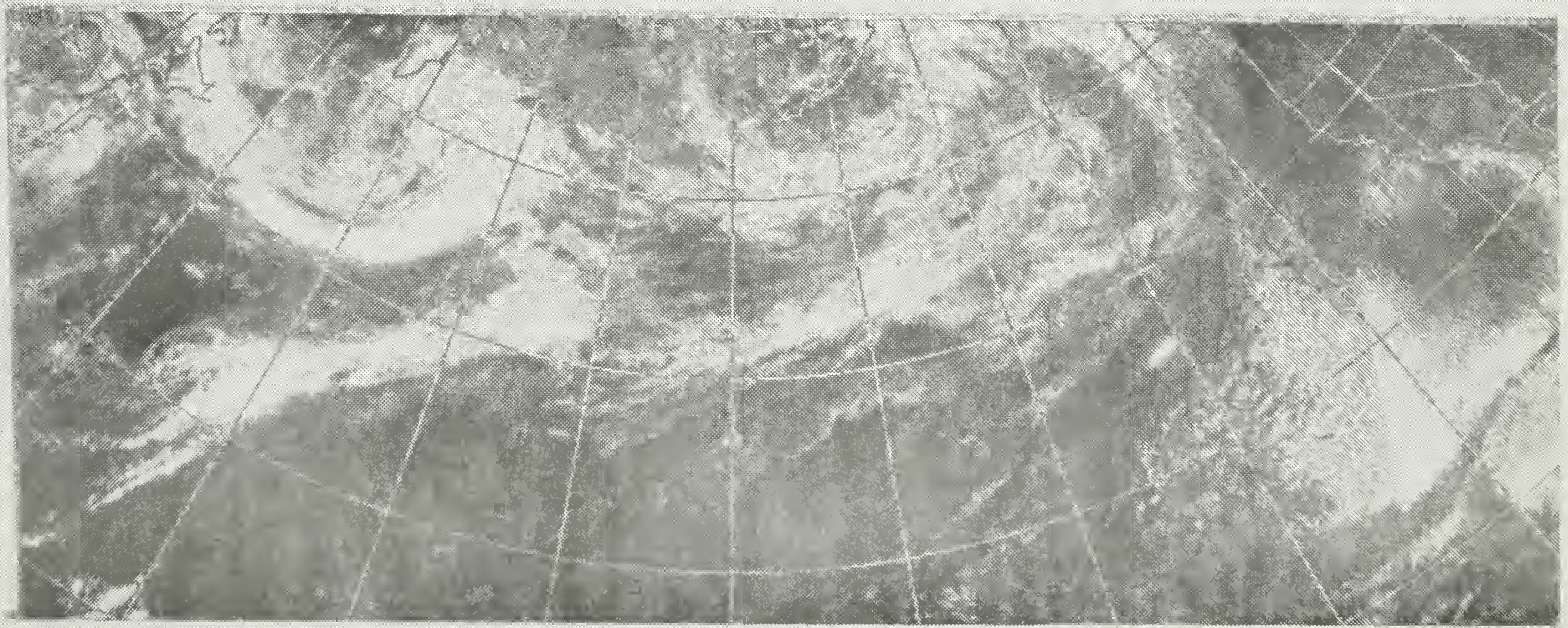


Figure 16. Digitally Composited NOAA-2 Mosaic of SRVIS Data for 1 July 1973 Within Study Area

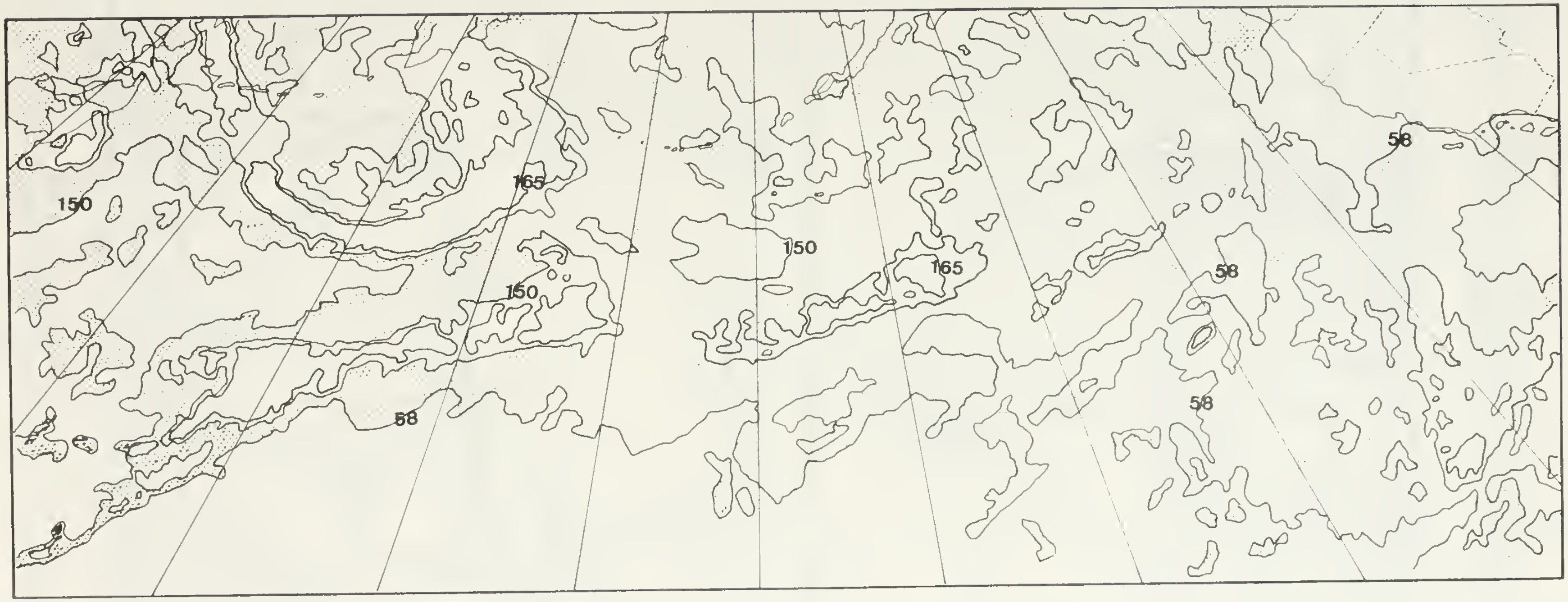
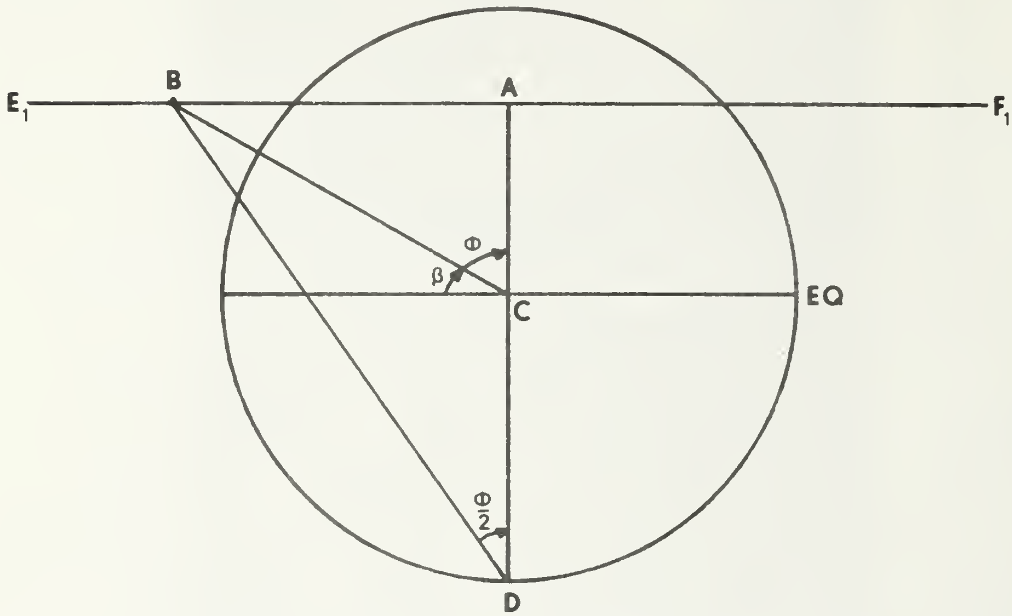
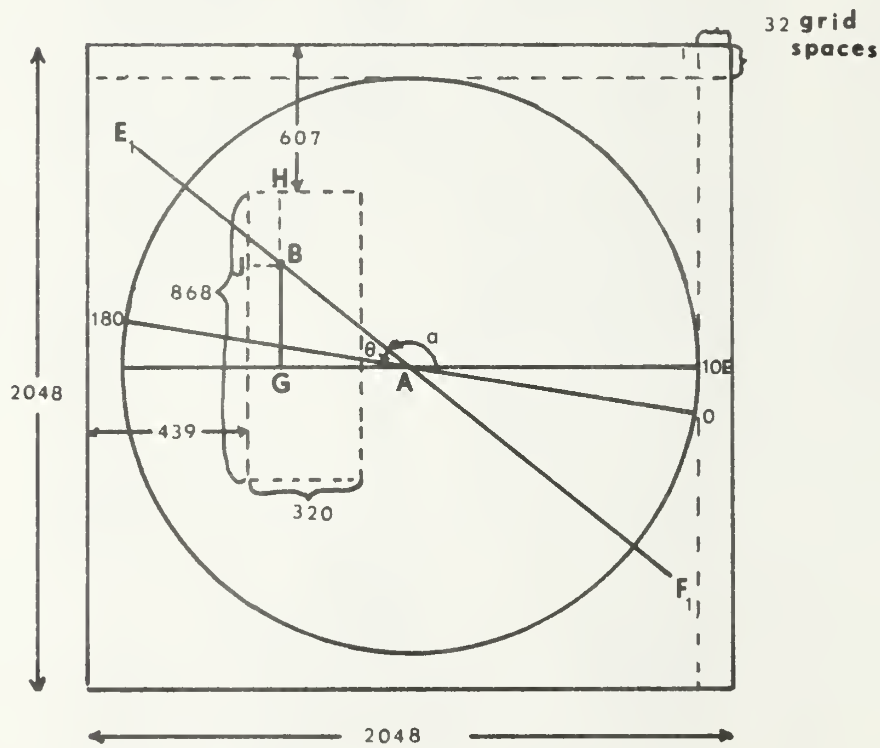


Figure 17. Analysis of Selected SRVIS Digital Count Values (i.e. 58, 150, 165) for 1 July 1973 Within Study Area. The Shaded Portion Represents Potential Areas of Fog Not Obscured by Middle- or High-Level Clouds

A. Plan View of Earth; AD Along Polar Axis With North at the Top. Line $E_1 F_1$, Perpendicular to Polar Axis and in Plane EF, Intersects Earth's Surface at 60N. See Appendix A for explanation of symbols.





B. Plane EF. See Appendix A for explanation of symbols.

Figure 18. Trigonometric Relationships Used in "Earth-Location" of Satellite Data

CATEGORY	GENERAL DESCRIPTION	IDENTIFYING WEATHER ELEMENT		FOG CHARACTERISTICS					NUMBER OF OBS
				DEPTH OF SEA		VISIBILITY		TIME OF OCCURRENCE	
		SYMBOL	CODE FIGURE	FT	M	MI	KM		
0	ALL OTHER OBSERVATIONS NOT IN CATEGORIES 1-10	--	--	--	--	--	--	--	1877
1	DEEP LIGHT FOG AT STATION	WW	10	≥ 33	≥ 10	$\frac{5}{8} - 6$	1 - 10	AT OBSERVATION	72
2	SHALLOW HEAVY FOG AT STATION	WW	11,12	≤ 33	≤ 10	$< \frac{5}{8}$	< 1	AT OBSERVATION	29
3	HEAVY FOG AT STATION	WW	28	≥ 33	≥ 10	$< \frac{5}{8}$*	< 1*	WITHIN ONE HR OF OB BUT NOT AT OB	39
4	HEAVY FOG AT A DISTANCE FROM STATION	WW	40	≥ 33	≥ 10	$< \frac{5}{8}$	< 1	AT OBSERVATION	23
5	HEAVY FOG AT STATION	WW	41-49	≥ 33	≥ 10	$< \frac{5}{8}$	< 1	AT OBSERVATION	452
6	OBS IN CATEGORIES 1-5 WITH POSSIBLE HIGH CLOUD CONTAMINATION	--	--	--	--	--	--		125
7	PAST WEATHER HEAVY FOG, OR SMOKE	W	4	--	--	$\leq \frac{5}{8}$*	< 1*	IN PERIOD 1-6 HRS BEFORE OB	103
8	OBS NOT IN CATEGORIES 1-7 REPORTING $\geq$ 5/8 STRATUS COVER	CL	6	--	--	--	--	AT OBSERVATION	294
9	OBS NOT IN CATEGORIES 1-8 WITH CLEAR SKIES	N	≤ 1	--	--	--	--	AT OBSERVATION	242
10	OBS WITH MISSING SRVIS AND/OR SRIR-DAY DATA	--	--	--	--	--	--	--	215
									3471

*At time of visibility restriction indicated by code figure.

Table I. Format Used to Categorize Ship Reports for North Pacific Ocean Study Area During July 1973

Lower Cutoff Values

Upper Cutoff Values

	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	127	125	128	126	124	128	120	113	116	110	106	98	98	100	95	91	92	89	83	73
122	136	134	137	135	133	137	129	122	124	119	115	106	107	108	103	99	101	97	92	81
124	144	142	145	143	141	144	137	129	132	126	123	114	115	116	111	107	108	104	99	89
126	157	155	158	156	153	157	150	142	145	139	135	126	127	128	123	119	120	117	111	101
128	176	174	177	175	173	176	169	161	163	157	154	145	145	147	141	137	138	135	129	118
130	192	190	193	191	188	192	184	176	179	173	169	160	160	162	156	152	153	150	144	133
132	195	193	195	194	191	195	187	179	181	175	171	162	163	164	158	154	155	152	146	135
134	201	200	202	200	197	201	193	185	188	181	178	168	169	170	165	160	161	158	152	141
136	217	215	218	216	213	217	209	201	203	197	193	183	184	185	179	175	176	173	166	155
138	228	226	229	227	224	228	220	211	213	207	203	193	194	195	190	185	186	183	176	165
140	241	239	242	240	237	240	232	224	226	219	215	206	206	207	202	197	198	195	188	177
142	246	244	247	245	242	245	237	228	231	224	220	210	211	212	206	201	203	199	192	181
144	295	293	295	293	290	293	285	275	278	271	266	256	257	258	252	247	248	244	237	225
146	337	335	337	335	332	335	326	317	319	311	307	296	297	298	291	286	287	283	276	264
148	354	352	354	352	348	352	343	333	335	327	323	312	312	314	307	302	303	299	292	279
150	401	398	400	398	394	397	388	378	380	372	367	356	356	357	351	345	346	342	334	321
152	425	423	425	422	419	422	412	401	403	395	391	379	379	380	373	367	368	364	356	343
154	462	459	461	458	455	457	448	436	438	430	425	413	413	414	407	401	402	397	389	375
156	490	487	489	487	482	485	475	463	465	456	452	439	439	440	433	426	427	423	414	400
158	512	510	511	509	504	507	497	485	487	478	473	460	459	460	453	447	448	443	434	420
160	509	507	508	506	501	504	494	481	483	474	469	456	456	457	449	443	444	439	430	415
162	524	521	523	520	515	518	507	495	497	487	482	469	469	470	462	455	456	451	442	427
164	519	516	518	515	511	513	503	490	492	482	477	464	463	464	456	450	451	446	436	421
166	540	537	539	536	531	534	523	510	511	50[illegible]	496	482	482	483	475	468	469	463	454	438
168	515	512	514	511	506	509	498	485	487	477	471	457	457	458	450	443	444	438	429	413
170	521	518	520	517	513	516	504	491	493	482	477	463	462	463	455	448	449	444	434	418
172	491	488	490	487	482	486	474	461	463	453	447	433	432	433	425	418	419	414	404	388
174	434	431	434	431	426	430	418	405	407	397	391	377	377	378	370	363	364	359	349	333
176	368	365	368	365	360	365	353	340	343	333	327	313	313	314	306	299	301	295	286	270
178	314	311	314	311	307	311	300	287	290	280	274	260	261	262	254	247	249	243	234	218
180	250	247	250	247	243	248	237	224	227	218	212	198	199	201	192	186	188	182	173	157
182	187	184	188	185	181	187	175	163	166	157	151	137	139	141	132	126	128	123	114	98
184	132	129	133	130	127	135	121	109	113	104	99	85	86	88	80	74	76	71	62	47
186	89	86	91	88	84	91	79	67	72	63	57	43	45	47	39	33	36	30	22	6
188	37	34	39	36	32	40	28	16	21	12	7	-6	-4	-1	-9	-15	-13	-18	-26	-41
190	21	18	23	20	17	24	13	1	6	-2	-7	-21	-19	-16	-24	-30	-28	-33	-41	-56
192	5	2	7	4	1	8	-2	-14	-9	-17	-23	-36	-34	-32	-40	-45	-43	-48	-56	-71
194	5	2	7	4	1	8	-2	-14	-9	-17	-23	-36	-34	-32	-40	-45	-43	-48	-56	-71
196	5	2	7	4	1	8	-2	-14	-9	-17	-23	-36	-34	-32	-40	-45	-43	-48	-56	-71
198	5	2	7	4	1	8	-2	-14	-9	-17	-23	-36	-34	-32	-40	-45	-43	-48	-56	-71

Table II. Skill Score Analysis for Selected SRIR-DAY Count Values: Category 5 Versus Category 9

Lower Cutoff Values

Upper Cutoff Values	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	97	95	98	97	95	100	95	91	93	86	81	75	77	77	73	70	71	67	64	58
122	105	103	106	105	103	108	103	99	101	93	89	82	84	84	80	77	79	74	72	65
124	111	110	113	112	110	114	110	105	107	100	95	88	90	91	86	83	85	80	78	71
126	121	119	122	121	119	123	119	114	116	108	104	97	99	99	95	92	93	89	86	80
128	136	135	137	136	134	138	134	129	131	123	118	112	113	114	109	106	107	103	100	93
130	149	148	151	149	147	151	147	142	144	136	131	124	126	126	121	118	120	115	112	105
132	148	147	150	148	146	151	146	141	143	135	130	123	125	125	120	117	118	114	111	104
134	154	153	156	154	152	157	152	147	149	140	136	128	130	130	126	122	124	119	116	109
136	170	169	172	170	168	172	167	162	164	156	151	143	145	145	140	137	138	134	130	123
138	183	182	185	183	181	185	180	175	177	168	163	155	157	157	152	149	150	145	142	135
140	198	196	199	198	195	200	194	189	191	182	177	169	170	171	166	162	163	159	155	148
142	204	203	205	204	201	206	200	195	197	187	182	174	176	176	171	167	169	164	160	153
144	242	241	244	242	239	244	238	232	234	224	218	210	212	212	206	202	204	198	195	187
146	277	275	278	277	274	278	272	266	267	257	251	242	244	244	238	234	235	229	225	217
148	297	296	299	297	294	298	292	285	287	276	270	261	262	262	256	252	253	248	243	235
150	334	332	335	333	329	334	327	320	321	310	304	294	296	295	289	285	286	280	275	267
152	361	359	362	360	356	360	353	346	347	335	329	319	320	320	313	308	310	304	299	290
154	392	390	393	391	387	391	384	376	377	365	358	348	349	348	342	336	338	331	326	317
156	429	427	430	428	425	427	419	411	412	399	392	381	382	381	374	369	370	363	358	347
158	455	453	456	454	449	453	445	437	437	423	416	405	405	405	397	392	393	386	380	369
160	454	452	455	453	448	452	444	435	436	421	414	402	403	402	395	389	390	383	377	366
162	480	477	480	478	473	476	468	459	459	444	436	424	425	424	417	410	412	404	398	387
164	478	476	478	476	471	475	466	457	457	442	434	422	422	422	414	407	409	401	395	383
166	502	500	502	500	494	498	489	479	479	463	455	442	442	442	433	426	428	420	413	40[illegible]
168	492	490	492	490	484	488	479	469	469	453	444	431	432	431	422	415	417	408	402	389
170	510	507	510	507	501	505	496	485	486	468	459	446	446	446	437	429	431	422	415	403
172	480	478	481	478	472	477	467	456	457	440	430	417	418	417	408	401	402	394	387	374
174	432	429	433	430	424	429	419	409	410	393	383	369	371	370	361	354	356	347	340	327
176	374	372	375	373	367	373	363	353	354	337	328	314	315	315	306	299	301	292	286	273
178	319	316	320	318	312	319	309	299	301	284	274	261	263	262	253	247	249	240	234	221
180	254	251	256	253	248	256	246	236	238	222	213	199	202	202	193	187	189	180	174	162
182	193	190	196	193	188	196	187	177	180	164	155	142	145	145	137	131	133	125	119	107
184	142	139	145	143	138	147	137	129	132	116	107	94	98	98	90	84	87	78	73	61
186	95	92	99	96	92	101	92	84	87	72	63	50	54	55	47	41	44	36	31	19
188	38	36	43	40	37	46	37	29	34	19	11	-1	2	3	-4	-9	-6	-14	-19	-30
190	23	21	28	25	22	32	23	15	19	5	-3	-15	-11	-10	-18	-23	-19	-27	-32	-44
192	5	3	10	8	4	15	6	-1	3	-10	-19	-32	-27	-26	-34	-39	-35	-43	-48	-59
194	5	3	10	8	4	15	6	-1	3	-10	-19	-32	-27	-26	-34	-39	-35	-43	-48	-59
196	5	3	10	8	4	15	6	-1	3	-10	-19	-32	-27	-26	-34	-39	-35	-43	-48	-59
198	5	3	10	8	4	15	6	-1	3	-10	-19	-32	-27	-26	-34	-39	-35	-43	-48	-59

Table III. Skill Score Analysis for Selected SRIR-DAY Count Values: Categories 1-5 Versus Category 9

Lower Cutoff Values

Upper Cutoff Values	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	118	112	116	110	98	99	93	97	101	95	95	89	90	88	81	79	76	73	61	58
122	134	128	132	126	114	115	109	113	117	111	111	105	106	104	97	95	92	89	77	74
124	147	140	144	138	126	128	121	125	129	124	124	117	118	116	109	107	104	101	89	86
126	159	153	157	151	139	140	134	138	142	136	136	130	131	128	122	119	117	114	102	98
128	172	165	170	163	151	153	146	150	154	149	149	142	143	141	134	132	129	126	114	111
130	188	181	185	179	167	168	162	166	170	164	164	158	159	156	150	147	144	141	129	126
132	179	172	177	170	158	159	153	157	161	155	155	149	150	147	141	138	136	133	120	117
134	198	191	196	189	177	178	172	176	180	174	174	168	169	166	160	157	154	151	139	136
136	206	200	204	197	185	187	180	184	188	182	182	176	177	174	168	165	162	159	147	144
138	216	209	213	207	194	196	189	193	197	191	191	185	186	183	177	174	171	168	156	153
140	238	232	236	229	217	218	212	215	220	214	214	207	208	206	199	196	194	190	178	175
142	262	255	259	253	240	242	235	239	243	237	237	230	231	229	222	219	217	213	201	197
144	289	282	286	280	267	268	262	265	270	264	264	257	258	255	249	246	243	240	227	224
146	308	301	305	298	285	287	280	284	288	282	282	275	276	274	267	264	261	258	245	242
148	351	345	349	342	329	330	324	327	332	325	325	319	320	317	310	307	304	301	288	285
150	382	375	379	372	359	360	353	357	362	355	355	348	349	346	340	337	334	330	317	314
152	411	404	408	402	388	389	382	386	391	384	384	377	378	375	368	365	362	359	346	342
154	448	441	446	439	425	426	419	423	428	421	421	414	415	412	405	402	399	395	382	379
156	468	461	465	458	444	445	438	442	447	440	440	433	434	431	424	421	418	414	401	397
158	491	484	488	481	467	468	461	465	470	463	463	456	457	454	447	443	440	437	423	420
160	491	484	489	481	467	469	461	465	470	463	463	456	457	454	446	443	440	437	423	420
162	493	486	490	483	469	470	463	467	471	465	465	457	458	455	448	445	442	438	424	421
164	490	483	487	480	466	467	460	464	468	461	461	454	455	452	445	442	438	435	421	418
166	498	491	495	488	474	475	468	472	476	469	469	462	463	459	452	449	446	442	428	425
168	494	487	491	484	469	470	463	467	472	465	465	457	458	455	448	445	441	438	424	420
170	496	488	493	485	471	472	465	469	473	466	466	459	460	457	449	446	443	439	425	422
172	454	446	451	443	429	430	423	427	432	425	425	417	418	415	408	405	401	398	384	380
174	386	379	384	376	362	363	356	360	365	358	358	350	351	348	341	338	335	331	317	313
176	314	307	311	304	290	291	284	288	293	286	286	279	280	277	270	266	263	260	246	242
178	253	246	250	243	229	231	223	228	232	226	226	218	220	216	209	206	203	199	186	182
180	199	192	197	189	175	177	170	174	179	172	172	165	166	163	156	153	150	146	132	129
182	142	135	140	133	118	121	113	118	123	116	116	109	110	107	100	97	94	90	76	73
184	101	94	99	91	77	80	72	77	82	75	75	68	69	66	59	56	53	49	36	32
186	61	54	59	51	37	40	32	37	42	35	35	28	30	27	19	16	14	10	-3	-6
188	16	9	14	7	-6	-4	-11	-7	-2	-8	-8	-15	-14	-17	-24	-27	-30	-33	-47	-51
190	6	0	4	-2	-16	-14	-21	-17	-11	-18	-18	-25	-24	-26	-34	-37	-39	-43	-57	-60
192	-6	-14	-8	-16	-30	-27	-35	-30	-25	-31	-31	-39	-37	-40	-47	-50	-53	-56	-70	-74
194	-6	-14	-8	-16	-30	-27	-35	-30	-25	-31	-31	-39	-37	-40	-47	-50	-53	-56	-70	-74
196	-6	-14	-8	-16	-30	-27	-35	-30	-25	-31	-31	-39	-37	-40	-47	-50	-53	-56	-70	-74
198	-6	-14	-8	-16	-30	-27	-35	-30	-25	-31	-31	-39	-37	-40	-47	-50	-53	-56	-70	-74

Table IV. Skill Score Analysis for Selected SRIR-DAY Count Values: Category 8 Versus Category 9

Lower Cutoff Values

Upper Cutoff Values	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	32	36	35	39	48	50	49	37	36	35	32	28	28	32	32	30	34	33	38	29
122	27	31	30	34	43	46	44	32	31	30	27	23	23	27	27	25	29	28	33	25
124	24	28	27	31	40	43	41	29	28	27	24	20	20	24	24	22	26	25	30	22
126	26	30	29	33	42	45	43	31	30	29	25	22	22	26	26	24	28	27	32	23
128	34	38	37	41	50	53	51	40	39	38	34	30	30	34	34	32	36	35	40	32
130	36	40	39	43	52	55	53	41	40	40	36	32	32	36	36	34	38	37	42	33
132	46	50	49	53	62	65	63	51	50	49	45	42	42	45	45	44	47	47	51	43
134	35	39	38	42	51	54	52	40	39	38	34	31	31	35	35	33	37	36	41	32
136	43	47	46	50	59	62	60	48	47	46	42	38	38	42	42	40	44	43	48	40
138	45	49	48	52	61	64	62	50	49	48	44	40	40	44	44	42	46	45	50	42
140	36	41	40	44	53	56	54	42	41	40	36	32	32	36	36	34	38	37	42	33
142	17	21	20	25	34	37	35	23	22	21	17	13	13	17	18	16	20	19	24	15
144	40	45	43	48	57	61	58	46	45	44	40	35	35	40	40	38	42	41	46	37
146	63	67	66	71	80	83	81	68	67	66	62	57	57	62	62	59	64	63	68	58
148	36	41	40	44	54	57	55	42	41	40	36	32	32	36	36	34	38	37	43	33
150	51	55	54	59	69	72	70	56	55	54	50	45	45	50	50	48	52	51	56	47
152	43	47	46	51	61	64	62	48	47	46	42	37	37	42	42	40	44	43	49	39
154	38	42	41	46	56	60	58	44	43	42	37	32	33	37	37	35	40	38	44	34
156	41	46	44	49	60	64	61	47	46	45	40	36	36	40	40	38	43	42	47	37
158	35	39	38	43	54	58	55	41	40	39	34	29	29	34	34	32	37	36	41	31
160	24	29	28	33	44	48	46	31	30	29	24	19	20	24	24	22	27	26	32	22
162	31	37	35	40	52	55	53	38	37	36	31	26	26	31	31	29	34	33	39	28
164	24	29	28	33	44	48	45	31	29	28	23	19	19	24	24	21	26	25	31	21
166	27	32	31	36	48	51	49	34	33	31	26	22	22	27	27	25	29	28	35	24
168	0	4	3	8	20	24	22	7	6	5	0	-4	-4	0	0	-1	3	2	8	-1
170	-1	4	3	8	20	24	22	6	5	4	0	-5	-5	0	0	-2	3	1	8	-2
172	6	12	10	16	28	32	29	14	13	12	6	2	2	7	7	5	10	9	15	4
174	14	19	18	23	35	39	37	21	20	19	14	9	9	14	14	12	17	16	23	12
176	20	26	25	30	42	46	43	28	27	25	20	15	15	21	21	18	23	22	29	18
178	28	34	32	38	50	54	51	36	34	33	28	23	23	28	28	26	31	30	36	25
180	21	27	26	31	43	47	45	29	28	26	21	16	16	22	22	19	24	23	30	19
182	21	27	26	31	43	47	45	29	28	26	21	16	16	22	22	19	24	23	30	19
184	13	19	17	23	35	39	37	21	20	19	13	8	8	14	14	12	17	16	22	11
186	16	21	20	26	38	42	39	24	22	21	16	11	11	16	16	14	19	18	25	13
188	16	21	20	26	38	42	39	24	22	21	16	11	11	16	16	14	19	18	25	13
190	12	17	16	22	34	38	35	20	18	17	12	7	7	12	13	10	15	14	21	10
192	12	17	16	22	34	38	35	20	18	17	12	7	7	12	13	10	15	14	21	10
194	12	17	16	22	34	38	35	20	18	17	12	7	7	12	13	10	15	14	21	10
196	12	17	16	22	34	38	35	20	18	17	12	7	7	12	13	10	15	14	21	10
198	12	17	16	22	34	38	35	20	18	17	12	7	7	12	13	10	15	14	21	10

Table V. Skill Score Analysis for Selected SRIR-DAY Count Values: Category 5 Versus Category 8

Lower Cutoff Values

Upper Cutoff Values	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	80	82	83	86	87	91	91	87	89	80	78	70	70	74	72	67	73	70	70	64
122	76	77	78	81	82	86	86	82	83	75	73	65	65	69	67	63	68	65	64	59
124	73	74	75	78	79	83	82	79	80	72	70	63	63	66	64	60	65	62	61	56
126	72	73	74	77	78	82	81	77	79	71	69	62	62	65	63	59	64	61	61	55
128	83	84	85	88	89	93	92	89	90	83	81	74	74	77	76	72	77	74	74	69
130	87	89	90	92	94	97	97	94	95	88	86	79	80	83	81	77	82	79	79	75
132	84	86	87	89	90	94	94	90	92	85	83	76	77	80	78	74	79	76	76	72
134	77	78	79	81	82	86	85	82	83	77	74	68	68	71	70	66	70	67	67	63
136	86	87	88	90	92	95	95	92	93	87	85	79	79	82	80	77	81	78	79	74
138	86	88	88	91	92	95	95	92	93	87	85	79	79	82	81	77	82	79	79	75
140	86	87	68	90	91	95	94	91	93	87	85	79	79	82	81	77	81	79	79	75
142	79	81	81	83	84	87	87	84	86	80	78	72	72	75	74	70	74	72	72	68
144	89	90	91	93	94	97	97	94	95	90	88	83	83	86	85	82	85	83	83	80
146	97	98	99	101	102	105	105	102	104	98	97	92	92	95	94	91	94	92	93	89
148	88	89	89	91	92	95	95	92	93	88	87	82	82	84	33	81	84	82	82	79
150	95	96	96	98	99	102	102	99	100	96	94	90	90	92	91	89	92	90	90	87
152	90	91	91	93	94	96	96	94	95	90	89	85	85	87	86	83	87	85	85	82
154	85	86	87	89	89	92	91	89	90	86	84	80	80	82	81	79	82	80	80	77
156	91	91	92	94	95	97	97	95	96	91	90	86	86	88	87	85	88	86	86	84
158	87	87	88	89	90	92	92	90	91	87	86	82	82	84	83	81	84	82	82	79
160	78	78	79	80	81	83	83	81	82	78	76	73	73	74	74	71	74	72	72	70
162	75	76	76	78	79	81	80	78	79	75	74	70	70	72	71	69	72	70	70	67
164	65	65	66	67	68	69	69	67	68	64	63	59	59	61	60	58	60	59	59	56
166	66	66	67	68	69	70	70	68	69	65	64	61	61	62	61	59	61	60	60	57
168	58	59	59	61	61	63	62	61	61	57	56	53	53	54	53	51	54	52	52	50
170	54	55	55	57	57	59	58	56	57	53	52	49	49	50	49	47	50	48	48	46
172	47	48	48	50	50	51	51	49	50	46	45	42	42	43	42	40	42	41	41	38
174	42	42	43	44	44	45	45	43	44	40	39	36	36	37	36	34	36	35	35	32
176	36	36	37	38	38	39	39	37	38	34	33	30	30	31	30	28	30	29	28	26
178	29	30	30	31	31	33	32	30	31	27	26	23	23	24	23	21	23	22	21	19
180	23	23	23	24	25	26	25	24	24	20	19	16	16	17	16	14	16	15	14	12
182	16	17	17	18	18	19	19	17	17	14	12	9	9	10	9	7	9	8	7	5
184	12	13	13	14	14	15	15	13	13	10	8	5	5	6	5	3	5	4	3	1
186	9	9	9	10	10	12	11	9	10	6	5	2	2	3	2	0	1	0	0	-2
188	5	6	6	7	7	8	8	6	6	3	1	-1	-1	0	-1	-3	-1	-2	-3	-5
190	5	5	5	6	o	7	7	5	5	2	1	-1	-2	-1	-2	-4	-2	-3	-4	-6
192	4	4	5	5	6	7	6	4	5	1	0	-2	-2	-1	-2	-4	-3	-4	-4	-7
194	4	4	4	5	5	6	6	4	4	1	0	-2	-3	-2	-3	-5	-3	-4	-5	-7
196	3	4	4	5	5	6	6	4	4	1	0	-3	-3	-2	-3	-5	-3	-4	-5	-7
198	3	4	4	5	5	6	6	4	4	1	0	-3	-3	-2	-3	-5	-3	-4	-5	-7

Table VI. Skill Score Analysis for Selected SRIR-DAY Count Values: Categories 1-5 Versus No Fog

Upper Cutoff Values \ Lower Cutoff Values	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	29	32	31	30	31	29	27	30	28	26	23	20	18	17	21	18	21	19	16	13
122	27	29	28	28	28	27	24	27	25	23	21	17	16	15	19	16	19	16	14	10
124	21	24	23	22	23	21	19	22	20	18	16	12	10	9	14	11	13	11	8	5
126	12	15	13	13	14	12	10	13	11	9	7	3	2	0	5	2	5	3	0	-2
128	14	17	16	15	16	14	12	15	13	11	9	5	3	2	7	4	7	4	2	-1
130	15	18	17	16	17	15	13	16	14	12	10	6	4	3	8	5	7	5	2	0
132	17	20	18	18	19	17	14	18	16	14	11	7	5	4	9	6	9	6	3	0
134	17	21	19	19	20	18	15	19	17	14	12	8	6	5	10	7	10	7	4	1
136	27	30	29	28	29	27	24	28	26	23	21	17	15	13	18	15	18	15	12	8
138	24	27	25	25	26	24	21	24	22	20	17	13	11	10	15	11	15	12	9	5
140	25	28	27	26	27	25	22	26	24	21	18	14	12	11	16	12	16	13	10	6
142	25	29	27	26	28	25	22	26	24	21	18	14	12	10	16	12	16	13	9	5
144	34	38	36	35	36	34	30	35	32	29	26	21	19	18	23	19	23	20	16	12
146	41	45	43	42	43	40	37	41	38	35	32	27	24	23	28	24	28	25	21	16
148	29	34	32	31	32	29	26	30	28	24	21	16	13	12	18	14	18	14	10	6
150	45	49	47	46	47	44	40	45	42	38	34	29	26	24	31	26	30	27	22	17
152	59	63	61	60	61	58	53	58	55	51	46	40	38	36	42	37	41	38	33	28
154	56	61	58	57	58	55	50	55	52	47	43	37	33	31	38	33	38	34	29	23
156	80	85	82	81	82	78	72	77	73	68	63	56	53	50	57	52	56	52	47	40
158	58	64	61	60	62	57	52	58	54	49	43	36	32	30	38	32	37	33	27	21
160	80	86	83	81	82	78	72	77	73	67	62	54	50	47	55	49	54	49	43	36
162	90	96	93	91	92	87	80	86	81	75	69	60	56	53	62	55	60	55	49	41
164	77	84	80	78	80	75	68	74	69	63	57	48	43	41	50	43	49	43	37	29
166	44	52	48	47	49	43	36	44	39	33	27	17	13	10	21	14	20	15	8	0
168	49	58	54	52	54	48	40	49	43	37	30	20	15	12	24	16	23	17	10	1
170	36	45	41	39	42	35	27	37	31	24	17	7	2	0	11	3	11	5	-2	-10
172	14	25	20	18	21	15	7	18	12	6	0	-10	-15	-19	-5	-13	-5	-11	-19	-27
174	-2	8	4	1	6	0	-8	3	-2	-8	-15	-25	-30	-34	-19	-27	-19	-25	-32	-41
176	16	28	23	20	24	17	8	20	14	7	0	-11	-17	-20	-5	-14	-5	-12	-20	-29
178	4	17	12	9	14	6	-2	10	3	-2	-10	-22	-27	-31	-15	-24	-14	-21	-30	-39
180	-2	10	4	2	7	0	-9	4	-2	-8	-16	-28	-33	-37	-21	-30	-20	-27	-35	-45
182	2	15	10	7	12	4	-5	8	1	-4	-12	-24	-30	-33	-17	-26	-17	-24	-32	-42
184	10	24	18	15	20	12	2	15	8	1	-6	-18	-24	-28	-12	-21	-11	-18	-27	-37
186	13	26	21	18	22	14	4	18	11	3	-4	-16	-22	-26	-10	-19	-9	-17	-25	-35
188	-2	10	5	2	7	0	-10	4	-2	-9	-17	-29	-35	-38	-22	-31	-21	-28	-36	-46
190	0	13	8	5	10	2	-7	6	0	-6	-15	-27	-33	-36	-20	-29	-19	-26	-35	-45
192	0	13	8	5	10	2	-7	6	0	-6	-15	-27	-33	-36	-20	-29	-19	-26	-35	-45
194	0	13	8	5	10	2	-7	6	0	-6	-15	-27	-33	-36	-20	-29	-19	-26	-35	-45
196	0	13	8	5	10	2	-7	6	0	-6	-15	-27	-33	-36	-20	-29	-19	-26	-35	-45
198	0	13	8	5	10	2	-7	6	0	-6	-15	-27	-33	-36	-20	-29	-19	-26	-35	-45

Table VII. Skill Score Analysis for Selected SRIR-DAY Count Values: Categories 1-5 Versus Category 7

	Lower Cutoff Values																			
Upper Cutoff Values	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98
120	36	37	35	31	26	20	16	27	25	25	25	21	17	13	20	16	18	16	6	4
122	35	36	34	30	25	19	15	26	24	24	24	20	16	12	19	15	16	14	5	3
124	28	29	27	23	18	12	8	19	17	17	17	13	9	5	12	8	10	8	-1	-3
126	12	14	12	8	3	-2	-6	4	2	2	2	-1	-5	-9	-2	-6	-4	-6	-16	-18
128	11	13	10	6	1	-4	-8	3	1	1	1	-3	-7	-11	-3	-7	-5	-7	-17	-19
130	12	14	11	7	2	-3	-8	4	1	1	1	-2	-6	-10	-3	-7	-5	-7	-17	-19
132	10	12	9	5	0	-5	-9	2	0	0	0	-4	-8	-12	-4	-9	-7	-9	-19	-21
134	19	21	19	14	9	3	-1	11	9	8	8	4	0	-4	3	0	1	0	-11	-13
136	27	29	26	22	17	10	5	18	16	15	15	11	7	2	10	6	8	5	-4	-6
138	17	19	16	12	7	0	-4	8	6	5	5	1	-2	-7	0	-3	-1	-3	-14	-16
140	23	25	22	17	12	5	0	13	11	11	11	6	2	-2	5	1	3	1	-9	-11
142	37	39	36	31	26	18	13	27	25	24	24	19	14	10	18	13	15	13	2	0
144	37	39	36	31	25	17	12	26	24	23	23	18	13	9	17	13	14	12	0	-1
146	31	33	31	25	20	12	7	21	18	18	18	13	8	3	12	7	9	7	-4	-7
148	32	34	31	26	20	12	6	21	19	18	18	13	8	2	12	7	9	6	-5	-8
150	48	50	48	42	35	27	21	36	34	33	33	27	22	16	26	21	23	20	7	5
152	72	74	71	65	57	48	43	58	55	54	54	49	43	37	47	41	43	40	27	24
154	75	77	74	67	60	50	44	61	58	56	56	50	44	38	48	43	45	42	27	24
156	95	97	94	87	79	69	62	79	76	75	75	68	62	55	66	60	62	59	43	40
158	70	72	69	61	53	43	36	54	51	50	50	43	37	30	41	35	37	34	19	15
160	108	110	106	98	89	78	71	90	86	84	84	77	70	63	75	68	70	67	50	47
162	102	104	108	92	83	71	64	83	80	78	78	71	64	57	68	61	63	60	43	40
164	83	95	91	83	74	62	54	74	71	69	69	62	54	47	59	52	54	51	34	30
166	51	54	50	42	32	20	13	34	30	29	29	22	14	7	20	13	16	12	-5	-8
168	77	[illegible]	75	66	56	43	35	57	53	52	52	43	35	27	41	33	36	32	13	10
170	56	59	54	45	35	22	13	37	33	31	31	23	15	7	21	13	16	13	-6	-9
172	27	30	26	17	7	-5	-14	10	5	5	5	-3	-11	-19	-4	-12	-8	-12	-31	-35
174	-2	1	-3	-12	-21	-34	-43	-18	-22	-22	-22	-30	-38	-46	-31	-38	-35	-38	-57	-61
176	1	5	1	-7	-17	-30	-38	-13	-18	-18	-18	-26	-34	-42	-27	-34	-31	-35	-54	-57
178	-15	-11	-16	-25	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-42	-50	-46	-50	-69	-73
180	-15	-11	-15	-25	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-42	-51	-46	-50	-70	-73
182	-15	-11	-15	-25	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-42	-51	-46	-50	-70	-73
184	-5	-1	-6	-15	-25	-38	-47	-21	-25	-26	-26	-34	-43	-51	-34	-42	-38	-42	-62	-66
186	-5	-1	-6	-15	-25	-38	-47	-21	-25	-26	-26	-34	-43	-51	-34	-42	-38	-42	-62	-66
188	-19	-15	-20	-29	-38	-52	-60	-34	-38	-38	-38	-47	-55	-64	-47	-55	-51	-55	-74	-78
190	-14	-10	-15	-24	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-43	-51	-47	-51	-70	-74
192	-14	-10	-15	-24	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-43	-51	-47	-51	-70	-74
194	-14	-10	-15	-24	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-43	-51	-47	-51	-70	-74
196	-14	-10	-15	-24	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-43	-51	-47	-51	-70	-74
198	-14	-10	-15	-24	-34	-47	-56	-30	-34	-34	-34	-43	-51	-59	-43	-51	-47	-51	-70	-74

Table VIII. Skill Score Analysis for Selected SRIR-DAY Count Values: Category 8 Versus Category 7

Upper Cutoff Values \ Lower Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	120	135	180	195	210	215	213	224	240	242	241	235	229	216	209	217	201	187	187	187
142	123	138	184	199	213	219	217	228	244	246	245	239	232	220	213	221	205	191	190	190
144	137	152	198	212	227	232	231	241	256	259	259	253	245	233	226	233	217	203	203	202
146	157	172	217	232	247	252	250	261	277	279	278	272	264	252	245	252	235	221	221	220
148	164	179	225	240	254	260	258	268	285	286	285	279	272	259	252	259	242	228	227	227
150	171	186	232	247	261	266	264	275	291	293	292	285	278	265	258	265	249	234	233	233
152	176	191	237	252	267	272	270	280	297	298	297	291	283	270	263	270	254	239	238	238
154	184	199	245	260	274	279	277	288	304	306	305	298	291	278	270	273	261	246	245	245
156	197	212	259	273	288	293	291	302	318	319	318	312	304	291	283	290	273	259	258	257
158	198	213	259	274	289	294	292	303	319	320	319	313	305	292	284	291	274	259	258	258
160	201	216	263	278	292	297	295	306	322	324	322	316	308	295	287	294	277	262	261	261
162	205	220	267	282	297	302	300	310	327	328	327	320	312	299	291	299	281	266	265	265
164	218	233	280	295	310	315	312	323	340	341	340	333	325	311	303	311	293	278	277	276
166	226	241	288	303	318	323	321	331	348	349	348	341	333	319	311	318	301	285	284	284
168	228	243	291	306	320	325	323	334	350	351	350	343	335	321	313	320	303	287	286	286
170	238	253	300	315	330	335	332	343	360	361	359	352	344	330	322	329	312	296	295	294
172	250	265	312	327	342	347	344	355	372	373	371	364	356	342	334	341	323	307	306	305
174	270	285	332	347	362	366	364	374	391	392	390	383	374	360	352	359	341	325	324	323
176	282	298	345	360	374	379	376	387	403	404	402	395	386	372	364	370	352	336	335	334
178	291	306	354	368	383	388	385	395	412	413	411	403	395	380	372	379	360	344	343	342
180	293	309	356	371	386	390	387	398	414	415	413	406	397	383	374	381	362	346	345	344
182	306	322	369	384	398	403	400	410	427	428	426	418	409	395	386	393	374	358	357	355
184	321	337	384	399	414	418	415	426	442	443	441	433	424	409	401	407	388	372	370	369
186	329	345	392	407	421	426	423	433	450	450	448	440	431	417	408	414	395	379	377	376
188	332	348	395	409	424	428	425	436	452	453	451	443	434	419	410	417	397	381	380	378
190	340	355	403	417	432	436	433	443	460	460	458	450	441	426	418	424	405	388	387	385
192	344	359	407	421	436	440	437	448	464	464	462	454	445	430	421	428	408	392	390	389
194	352	367	415	429	444	448	445	455	472	472	470	462	453	438	429	435	415	399	397	396
196	362	378	425	440	454	459	455	466	482	482	480	472	463	448	439	445	425	408	407	405
198	358	374	422	436	451	455	452	462	479	479	477	468	459	444	435	441	422	405	404	402
200	360	376	423	438	452	457	453	464	480	481	478	470	461	446	437	443	423	406	405	403
202	365	381	428	443	458	462	459	469	485	486	483	475	466	451	442	448	428	411	410	408
204	375	391	438	453	467	472	468	479	495	495	493	484	475	460	451	457	437	420	418	417
206	380	396	444	458	473	477	474	484	500	501	498	490	480	465	456	462	442	425	423	421
208	383	399	446	461	476	480	476	487	503	503	501	492	483	467	458	464	444	427	426	424
210	382	398	445	460	474	479	475	486	502	502	500	491	482	466	457	463	443	426	425	423
212	376	392	440	455	470	474	470	481	498	498	495	487	477	462	453	459	439	421	420	418
214	382	398	446	461	475	479	476	486	503	503	501	492	482	467	458	464	444	426	425	423
216	390	406	454	469	483	487	484	494	511	511	509	500	490	475	465	471	451	434	432	430
218	390	406	454	469	483	487	484	494	511	511	509	500	490	475	465	471	451	434	432	430

Table IX. Skill Score Analysis for Selected SRVIS Count Values: Category 5 Versus Category 9

Lower Cutoff Values (columns); Upper Cutoff Values (rows)

Upper Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	123	133	171	184	197	200	201	211	223	225	224	214	209	196	192	198	183	172	169	169
142	124	134	173	186	198	202	202	213	225	226	225	215	211	197	193	199	184	173	170	170
144	134	145	183	196	209	212	212	223	235	237	235	225	221	206	202	208	193	183	179	179
146	151	162	200	213	226	229	229	240	252	253	252	241	237	222	216	224	206	197	193	194
148	162	172	211	224	237	240	240	251	263	264	262	251	247	232	228	234	218	207	203	203
150	172	182	221	234	246	249	249	260	272	273	271	261	256	241	237	242	227	215	211	211
152	175	185	224	237	250	253	253	263	275	277	275	264	259	244	240	245	229	218	214	214
154	183	193	232	245	258	261	261	271	284	285	283	271	267	252	247	253	237	225	221	221
156	194	205	244	257	269	272	272	283	295	296	294	282	278	262	257	263	247	235	231	231
158	194	204	244	257	270	273	272	283	295	297	294	283	278	262	258	263	247	235	231	231
160	195	206	245	259	272	274	274	285	297	298	296	285	280	264	259	265	248	237	232	232
162	199	209	249	262	275	278	278	289	301	302	300	288	283	267	263	268	251	240	235	235
164	209	220	259	273	286	289	288	299	311	312	310	298	293	277	272	278	261	249	244	244
166	214	225	265	278	291	294	294	305	317	318	315	303	298	282	277	282	265	253	249	248
168	218	226	268	282	295	297	297	308	320	321	319	306	301	285	280	286	268	256	252	251
170	225	235	275	289	302	304	304	315	327	328	325	313	308	291	286	292	275	262	258	257
172	235	246	286	300	313	315	315	326	338	338	336	323	318	301	296	301	284	271	267	266
174	252	263	303	316	329	331	331	342	354	354	351	339	333	316	311	316	298	286	281	280
176	263	274	314	327	340	342	342	353	365	365	362	349	343	326	321	326	308	295	290	290
178	273	284	324	337	350	352	351	362	374	375	372	358	352	335	330	335	316	303	298	298
180	275	286	326	339	352	354	353	364	376	377	373	360	354	337	331	336	318	305	300	299
182	292	303	343	356	369	371	370	381	393	393	390	376	370	352	347	352	333	320	314	314
184	308	319	359	372	385	386	385	396	408	408	405	391	385	367	361	365	346	333	328	327
186	316	327	367	380	393	394	393	404	416	416	412	398	392	374	368	372	353	340	334	333
188	318	329	369	382	395	396	395	406	418	418	414	400	394	376	370	374	355	341	336	335
190	326	337	377	390	403	404	403	414	426	426	422	407	401	383	377	381	362	348	343	342
192	329	339	380	393	405	407	406	416	428	428	424	410	404	385	379	384	364	350	345	344
194	335	346	386	399	411	413	412	422	434	434	430	416	409	391	385	389	369	355	350	349
196	343	354	394	407	420	421	420	430	442	442	438	423	417	398	392	396	376	362	357	356
198	339	350	390	403	416	418	416	427	439	439	435	420	414	395	389	393	373	359	354	353
200	340	351	391	404	417	418	417	428	440	440	436	421	414	395	389	394	374	360	354	353
202	346	357	397	410	423	424	423	434	446	446	441	426	420	401	395	399	379	365	359	358
204	357	368	409	422	434	436	434	445	457	457	452	437	430	411	405	409	389	374	368	367
206	361	372	413	426	439	440	438	449	461	461	456	441	434	415	409	413	392	378	372	371
208	364	375	415	428	441	442	440	451	463	463	458	443	436	417	410	414	394	380	374	372
210	362	373	414	427	439	440	439	450	462	461	457	441	435	415	409	413	393	378	372	371
212	356	367	408	422	434	436	434	445	457	457	452	437	430	411	405	409	388	374	368	367
214	361	372	413	426	439	440	438	449	461	461	457	441	434	415	408	412	392	377	372	370
216	367	378	419	432	445	446	445	456	468	467	463	447	440	421	414	418	398	383	377	376
218	370	381	421	435	447	448	447	458	470	469	465	449	442	423	416	420	399	385	379	377

Table X. Skill Score Analysis for Selected SRVIS Count Values: Categories 1-5 Versus Category 9

Lower Cutoff Values

Upper Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	151	147	200	220	234	246	237	240	253	251	246	244	245	241	235	248	245	238	232	237
142	160	156	209	230	243	255	246	249	262	260	255	253	254	250	244	257	254	247	241	246
144	166	162	215	236	249	262	253	255	269	267	262	259	260	256	250	263	260	253	247	252
146	173	169	222	243	256	269	259	262	275	274	268	266	266	263	257	270	267	260	254	259
148	176	172	225	246	259	272	262	265	278	276	271	269	269	266	260	273	270	263	257	262
150	183	178	232	252	266	278	269	272	285	283	278	276	276	273	266	280	276	270	263	268
152	186	181	235	255	269	281	272	275	288	286	281	278	279	276	269	282	279	272	266	271
154	192	188	241	262	275	288	278	281	294	292	287	285	285	282	276	289	285	279	272	277
156	210	205	259	279	293	305	296	298	311	309	304	302	302	299	293	306	302	295	289	294
158	218	214	267	288	301	314	305	307	320	318	313	310	311	308	301	314	311	304	298	303
160	242	238	291	312	325	338	328	331	344	342	336	334	334	331	325	338	334	328	321	326
162	241	237	290	311	324	337	327	330	343	341	336	333	334	330	324	337	333	327	320	325
164	241	236	290	310	324	336	327	329	343	341	335	333	333	330	323	336	333	326	320	325
166	251	246	300	320	334	346	337	339	353	351	345	342	343	339	333	346	343	336	330	334
168	258	253	307	328	341	354	344	346	360	357	352	349	350	346	340	353	350	343	336	341
170	279	274	328	349	362	375	365	367	381	378	373	370	371	367	361	374	370	363	357	362
172	301	296	349	370	383	396	386	388	402	399	394	391	392	388	382	395	391	384	378	382
174	304	299	353	374	387	399	390	392	405	403	397	395	395	392	385	398	395	388	381	386
176	315	310	364	384	398	410	400	403	416	413	408	405	405	402	395	408	405	398	392	396
178	318	313	367	387	401	413	403	406	419	417	411	408	409	405	399	412	408	401	395	399
180	325	320	374	395	408	420	411	413	426	424	418	415	416	412	405	419	415	408	402	406
182	332	327	381	402	415	428	418	420	433	431	425	422	423	419	412	426	422	415	408	413
184	336	331	385	405	419	431	421	423	437	434	428	426	426	423	416	429	426	419	412	417
186	347	342	396	416	429	442	432	434	447	445	439	436	437	433	427	440	436	429	422	427
188	354	349	403	423	437	449	439	441	454	452	446	443	444	440	434	447	443	436	429	434
190	365	360	414	434	447	460	450	452	465	463	457	454	454	451	444	457	454	447	440	445
192	361	356	409	430	443	456	446	448	461	459	453	450	450	447	440	453	450	443	436	441
194	368	363	417	437	451	463	453	459	468	466	460	457	457	454	447	460	457	450	443	448
196	379	374	428	448	462	474	464	466	479	476	471	468	468	465	458	471	467	460	454	458
198	382	377	431	451	465	477	467	469	482	480	474	471	471	468	461	474	470	463	457	461
200	382	376	430	451	464	477	467	469	482	479	473	471	471	467	461	474	470	463	456	461
202	385	380	434	455	468	480	470	472	485	483	477	474	474	471	464	477	474	466	460	465
204	392	387	441	462	475	487	477	479	492	490	484	481	481	478	471	484	480	473	466	471
206	400	394	448	469	482	495	484	486	499	497	491	488	488	485	478	491	487	480	474	478
208	403	398	452	472	486	498	488	490	503	500	494	492	492	488	482	494	491	484	477	482
210	407	401	455	476	489	501	491	493	506	504	498	495	495	492	485	498	494	487	480	485
212	396	393	447	468	481	493	483	485	498	496	490	487	487	484	477	490	486	479	472	477
214	398	393	447	468	481	493	483	485	498	496	490	487	487	484	477	490	486	479	472	477
216	406	400	454	475	488	501	491	492	505	503	497	494	494	491	484	497	493	486	480	484
218	406	400	454	475	488	501	491	492	505	503	497	494	494	491	484	497	493	486	480	484

Table XI. Skill Score Analysis for Selected SRVIS Count Values: Category 8 Versus Category 9

Lower Cutoff Values

Upper Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	-20	0	-2	-5	-1	-7	0	10	16	20	26	23	15	6	5	2	-10	-18	-12	-16
142	-26	-6	-8	-11	-7	-13	-5	4	10	14	20	17	10	0	0	-2	-15	-23	-18	-22
144	-19	1	0	-3	0	-5	2	12	17	22	27	24	17	8	7	4	-9	-17	-11	-15
146	-6	14	12	9	12	7	15	25	30	35	40	37	30	20	19	16	3	-4	0	-3
148	-1	18	16	13	16	11	19	29	34	39	44	41	34	24	23	20	7	0	4	0
150	-1	18	16	13	16	11	19	29	34	39	44	41	34	24	23	20	7	-1	4	0
152	0	20	18	15	18	13	21	31	37	41	47	43	36	26	25	22	9	0	6	2
154	0	21	19	16	19	14	22	32	38	42	48	44	37	27	26	25	9	1	7	3
156	-2	17	15	12	16	10	18	28	34	39	44	41	33	24	23	20	6	-1	3	0
158	-12	8	6	3	6	1	9	19	25	30	35	32	24	15	14	11	-2	-10	-5	-9
160	-33	-12	-14	-18	-14	-19	-11	0	4	9	15	12	4	-4	-5	-8	-22	-30	-25	-29
162	-29	-8	-10	-13	-10	-15	-7	3	9	13	19	16	9	0	-1	-4	-18	-26	-21	-25
164	-17	4	2	-1	2	-3	5	15	21	26	32	28	21	11	10	7	-6	-15	-9	-13
166	-19	1	0	-3	0	-5	2	13	19	23	29	26	18	8	7	4	-9	-17	-12	-16
168	-24	-3	-5	-8	-4	-10	-2	8	14	19	25	21	14	4	3	0	-13	-22	-16	-20
170	-37	-15	-17	-20	-17	-22	-14	-3	2	7	13	10	2	-7	-8	-11	-25	-33	-28	-32
172	-47	-25	-27	-30	-27	-32	-24	-13	-7	-2	3	0	-6	-16	-17	-20	-34	-43	-37	-41
174	-32	-10	-12	-15	-12	-17	-9	1	7	12	18	15	7	-2	-3	-6	-20	-29	-23	-27
176	-31	-9	-11	-15	-11	-16	-8	2	8	13	19	16	8	-1	-2	-5	-19	-28	-22	-26
178	-27	-4	-7	-10	-6	-12	-3	7	13	18	24	20	12	2	1	-1	-15	-24	-18	-22
180	-32	-9	-12	-15	-11	-17	-8	2	8	13	19	16	8	-1	-2	-5	-20	-29	-23	-27
182	-27	-5	-7	-11	-7	-12	-4	6	12	17	24	20	12	2	1	-1	-16	-24	-18	-23
184	-16	5	3	0	3	-2	6	17	23	28	34	31	23	12	11	8	-6	-14	-9	-13
186	-20	1	0	-4	0	-6	2	13	19	24	30	27	19	8	8	4	-9	-18	-12	-16
188	-26	-3	-5	-9	-5	-11	-2	8	14	19	26	22	14	4	3	0	-14	-23	-17	-21
190	-30	-7	-9	-13	-9	-15	-6	4	11	16	22	19	10	0	0	-3	-18	-27	-21	-25
192	-22	0	-2	-5	-2	-7	0	12	18	23	29	26	17	7	6	3	-11	-20	-14	-18
194	-23	0	-2	-6	-2	-8	0	11	18	23	29	25	17	7	6	3	-11	-20	-14	-18
196	-24	-1	-4	-7	-3	-9	0	10	16	21	28	24	16	5	4	1	-13	-22	-16	-20
198	-32	-9	-11	-15	-11	-17	-8	3	9	14	20	17	9	-1	-2	-5	-20	-29	-23	-27
200	-31	-8	-10	-14	-10	-16	-7	4	10	15	21	18	10	0	-1	-4	-19	-28	-22	-26
202	-30	-7	-9	-13	-8	-14	-5	5	11	16	23	19	11	0	0	-3	-18	-27	-21	-25
204	-29	-6	-8	-12	-8	-14	-5	6	12	17	24	20	12	1	0	-2	-17	-26	-20	-24
206	-32	-8	-11	-14	-10	-16	-7	3	10	15	21	18	9	0	-1	-4	-19	-28	-22	-27
208	-33	-10	-12	-16	-12	-18	-8	2	8	14	20	16	8	-2	-2	-6	-21	-30	-24	-28
210	-38	-15	-17	-21	-17	-23	-14	-2	3	8	15	11	3	-6	-7	-11	-26	-35	-28	-33
212	-36	-13	-15	-18	-14	-20	-11	0	6	11	17	14	6	-4	-5	-8	-23	-32	-26	-30
214	-31	-8	-10	-13	-9	-15	-6	4	11	16	22	19	10	0	0	-3	-19	-28	-21	-26
216	-31	-8	-10	-14	-10	-16	-6	4	10	16	22	19	10	0	0	-4	-19	-28	-22	-26
218	-31	-8	-10	-14	-10	-16	-6	4	10	16	22	19	10	0	0	-4	-19	-28	-22	-26

Table XII. Skill Score Analysis for Selected SRVIS Count Values: Category 5 Versus Category 8

Lower Cutoff Values

Upper Cutoff Values

	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	-3	11	7	4	8	2	11	22	25	30	34	27	23	12	14	11	0	-5	-3	-6
142	-12	3	0	-3	0	-5	3	14	17	22	27	20	16	4	6	4	-7	-12	-11	-13
144	-8	7	3	0	4	-1	7	18	21	26	31	24	20	8	10	8	-4	-9	-7	-9
146	2	18	14	11	14	8	18	29	32	36	41	34	30	18	20	17	5	0	1	0
148	9	26	21	18	21	15	25	36	39	44	48	41	37	25	27	24	11	6	8	5
150	12	29	24	21	24	18	28	39	42	47	51	44	40	28	30	27	14	9	10	8
152	12	29	24	21	24	18	28	39	42	47	51	44	39	28	29	27	14	8	10	8
154	13	30	25	22	26	19	29	40	44	48	53	45	41	29	31	28	15	10	11	9
156	8	25	20	17	20	14	24	35	39	43	48	41	36	24	26	23	10	5	7	4
158	-2	14	10	7	10	4	14	26	29	34	39	31	27	15	17	14	1	-4	-2	-4
160	-24	-7	-11	-14	-11	-17	-7	4	8	13	18	11	6	-5	-3	-5	-18	-24	-22	-24
162	-22	-4	-9	-12	-8	-14	-4	7	11	16	21	14	9	-2	0	-3	-16	-21	-19	-22
164	-12	5	0	-2	1	-5	5	17	20	25	30	23	18	6	8	5	-7	-13	-11	-13
166	-18	0	-4	-8	-4	-10	0	11	15	20	25	18	13	1	3	0	-12	-18	-16	-18
168	-21	-3	-8	-11	-7	-14	-3	8	11	17	22	14	10	-1	0	-2	-15	-21	-19	-21
170	-36	-18	-23	-26	-22	-28	-17	-5	-1	3	9	1	-2	-15	-13	-15	-28	-34	-32	-34
172	-48	-29	-34	-37	-33	-39	-28	-16	-12	-6	-1	-8	-13	-25	-23	-25	-39	-44	-42	-44
174	-36	-18	-22	-26	-22	-28	-17	-4	-1	4	9	2	-2	-14	-12	-15	-28	-34	-32	-34
176	-37	-18	-23	-26	-22	-29	-18	-5	-1	3	9	1	-2	-15	-13	-15	-29	-35	-32	-35
178	-32	-14	-18	-22	-18	-24	-13	0	3	8	14	6	1	-11	-8	-11	-25	-31	-28	-31
180	-38	-19	-24	-27	-23	-30	-18	-6	-2	3	8	1	-3	-16	-14	-16	-30	-36	-33	-36
182	-30	-11	-16	-19	-15	-22	-10	1	5	11	17	9	4	-8	-6	-9	-23	-28	-26	-29
184	-20	0	-5	-9	-5	-11	0	12	15	21	27	18	14	1	3	0	-13	-19	-17	-20
186	-24	-5	-10	-13	-9	-16	-4	8	12	17	23	15	10	-2	0	-3	-17	-23	-21	-23
188	-30	-10	-15	-19	-14	-21	-10	2	6	12	18	10	5	-7	-5	-8	-22	-28	-26	-29
190	-34	-15	-20	-23	-19	-25	-14	-1	2	8	14	6	1	-11	-9	-12	-26	-32	-30	-32
192	-29	-9	-14	-17	-13	-20	-9	4	8	13	19	11	6	-6	-4	-7	-21	-27	-25	-28
194	-31	-11	-16	-20	-15	-22	-11	2	6	11	17	9	4	-8	-6	-9	-23	-29	-27	-30
196	-36	-16	-21	-24	-20	-27	-15	-1	2	7	13	5	0	-12	-10	-13	-27	-33	-31	-33
198	-43	-23	-28	-32	-27	-34	-22	-9	-5	0	6	-1	-6	-19	-17	-20	-34	-40	-38	-40
200	-44	-24	-29	-32	-28	-35	-23	-9	-5	0	6	-1	-6	-19	-17	-20	-34	-40	-38	-40
202	-42	-22	-27	-30	-26	-33	-21	-8	-3	2	8	0	-5	-18	-16	-18	-33	-39	-36	-39
204	-41	-21	-26	-29	-25	-32	-20	-6	-2	3	9	1	-3	-17	-15	-17	-32	-38	-36	-38
206	-46	-25	-30	-34	-29	-36	-24	-10	-6	0	5	-2	-7	-21	-18	-21	-36	-42	-39	-42
208	-48	-27	-32	-36	-31	-38	-26	-12	-8	-2	3	-4	-9	-23	-20	-23	-38	-44	-41	-44
210	-54	-33	-39	-42	-37	-44	-32	-18	-14	-8	-1	-10	-15	-28	-26	-28	-43	-49	-47	-49
212	-52	-32	-37	-40	-36	-43	-30	-16	-12	-6	0	-8	-13	-27	-24	-27	-41	-47	-45	-48
214	-48	-28	-33	-36	-32	-39	-27	-13	-8	-2	3	-5	-10	-23	-21	-23	-38	-44	-42	-44
216	-51	-30	-35	-39	-34	-41	-29	-15	-11	-5	1	-7	-12	-25	-23	-26	-40	-46	-44	-47
218	-49	-28	-33	-37	-32	-39	-27	-13	-9	-3	3	-5	-10	-24	-21	-24	-39	-45	-42	-45

Table XIII. Skill Score Aanalysis for Selected SRVIS Count Values: Categories 1-5 Versus Category 8

Lower Cutoff Values

Upper Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	20	30	36	42	46	47	50	58	63	68	73	70	73	70	73	71	64	62	62	62
142	19	29	35	41	45	46	49	57	62	66	71	69	72	68	71	70	62	60	61	60
144	22	32	39	44	49	50	52	60	65	70	75	72	75	72	75	73	66	64	65	64
146	27	37	43	49	53	54	57	65	70	75	80	77	80	77	80	79	71	70	70	70
148	30	40	47	52	57	58	60	68	73	78	83	81	84	80	83	82	75	73	74	74
150	30	40	46	52	56	57	60	67	73	77	82	80	83	79	82	81	74	73	73	73
152	29	38	45	50	54	55	58	65	71	75	80	77	80	77	80	79	72	70	71	70
154	30	39	45	51	55	56	59	66	71	75	80	78	81	77	80	79	72	71	71	71
156	30	40	46	51	55	56	59	66	71	76	80	78	81	78	81	79	73	71	72	71
158	29	38	44	49	53	54	57	64	69	73	78	75	78	75	78	76	70	68	69	68
160	27	36	42	47	51	52	55	62	67	71	75	73	76	72	75	74	67	66	66	66
162	28	37	43	48	52	53	56	63	68	72	77	74	77	74	77	75	69	67	68	67
164	30	39	45	50	54	55	58	65	70	74	78	76	79	75	78	77	71	69	70	69
166	28	37	43	48	52	53	55	62	67	71	75	73	76	72	75	74	67	66	66	66
168	26	35	40	45	49	50	53	59	64	68	72	70	73	69	72	71	64	63	63	63
170	22	31	37	41	45	46	48	55	60	63	68	65	68	65	67	66	60	58	58	58
172	24	32	38	43	47	47	50	56	61	65	69	67	69	66	68	67	61	59	60	59
174	28	37	42	47	51	52	54	61	66	69	74	71	74	71	73	72	66	65	65	65
176	29	38	43	48	52	52	55	62	66	70	74	72	74	71	74	73	66	65	65	65
178	31	39	45	50	53	54	57	63	68	71	76	74	76	73	76	74	68	67	67	67
180	29	38	43	48	52	52	55	61	66	69	74	71	74	71	73	72	66	65	65	65
182	32	41	46	51	55	55	58	64	69	72	77	75	77	74	77	75	70	68	68	68
184	35	44	49	54	58	58	61	67	72	75	80	78	80	77	80	79	73	72	72	72
186	36	44	50	54	58	59	61	68	72	76	80	78	80	77	80	79	73	72	72	72
188	35	43	49	53	57	58	60	67	71	75	79	77	79	77	79	78	72	71	71	71
190	35	43	49	53	57	58	60	67	71	75	79	77	79	76	79	78	72	71	71	71
192	35	43	49	53	57	58	60	67	71	75	79	77	79	76	79	78	72	71	71	71
194	35	44	49	53	57	58	60	67	71	75	79	77	79	76	79	78	72	71	71	71
196	36	44	49	54	58	59	61	67	72	75	79	77	80	77	79	78	73	71	72	72
198	34	42	47	52	55	56	58	65	69	73	77	75	77	74	77	75	70	69	69	69
200	33	41	46	51	54	55	57	64	68	71	75	73	76	73	75	74	69	67	68	67
202	34	42	47	52	55	56	59	65	69	72	77	75	77	74	77	75	70	69	69	69
204	37	46	51	55	59	60	62	68	73	76	80	78	81	78	80	79	74	73	73	73
206	37	45	50	55	58	59	62	68	72	76	80	78	80	77	80	79	73	72	72	72
208	37	45	50	55	58	59	61	68	72	75	79	77	80	77	79	78	73	72	72	72
210	36	44	49	53	57	58	60	66	70	74	78	76	78	75	78	77	71	70	70	70
212	35	43	48	52	56	57	59	65	69	73	77	75	77	74	77	76	70	69	69	69
214	35	43	48	53	56	57	59	65	70	73	77	75	77	74	77	76	70	69	69	69
216	36	44	49	53	57	58	60	66	70	74	78	76	78	75	78	77	71	70	70	70
218	36	44	49	53	57	58	60	66	70	73	77	76	78	75	77	76	71	70	70	70

Table XIV. Skill Score Analysis for Selected SRVIS Count Values: Categories 1-5 Versus No Fog

Lower Cutoff Values (columns); Upper Cutoff Values (rows)

Upper Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	-20	-11	-17	-21	-8	-8	-2	10	6	2	6	7	17	9	9	3	-4	-5	0	-4
142	-16	-7	-13	-16	-4	-4	2	14	11	6	10	11	21	13	13	7	0	-1	2	-1
144	-14	-4	-11	-14	-2	-2	4	17	13	9	13	13	23	15	16	10	1	0	5	0
146	-3	5	-1	-4	7	7	14	27	23	19	23	23	33	24	25	18	10	8	13	8
148	-1	8	1	-2	10	10	17	30	27	22	26	26	36	27	28	21	12	10	15	11
150	-7	2	-3	-7	5	5	12	25	22	17	21	21	32	23	23	17	8	6	11	6
152	-9	0	-5	-9	3	3	10	24	20	15	19	20	30	21	22	15	6	4	10	5
154	-2	8	0	-3	10	10	17	31	27	22	26	26	37	28	28	21	12	10	15	10
156	-1	9	1	-2	11	11	19	32	28	23	27	27	38	29	29	22	13	11	16	11
158	-13	-3	-10	-14	0	0	7	22	18	13	17	17	28	19	20	13	3	2	7	2
160	-10	0	-7	-11	3	2	10	25	21	16	20	20	31	22	22	15	6	4	9	5
162	-17	-6	-13	-18	-3	-3	4	19	15	10	15	15	26	17	18	10	1	0	5	0
164	-8	2	-5	-9	5	5	13	28	24	18	23	23	34	25	25	18	8	6	12	6
166	-17	-5	-13	-17	-2	-2	6	21	17	12	16	17	28	19	19	12	2	0	6	1
168	-21	-10	-17	-22	-6	-6	2	17	13	8	12	13	25	15	16	8	-1	-2	3	-2
170	-24	-12	-20	-24	-8	-8	0	15	11	6	11	11	23	13	14	7	-2	-4	1	-3
172	-25	-12	-20	-25	-8	-8	0	16	11	6	11	11	24	14	14	7	-2	-4	1	-3
174	-14	-2	-10	-15	1	1	10	26	21	16	20	21	33	23	23	15	5	3	9	4
176	-14	-2	-10	-15	1	1	10	27	22	16	21	21	34	23	24	16	5	3	9	4
178	-6	6	-2	-7	9	9	18	35	30	24	29	29	42	31	31	23	12	9	16	10
180	-4	8	0	-5	11	10	20	36	31	25	30	30	43	32	32	24	13	10	17	11
182	7	20	10	5	22	22	31	48	43	36	41	41	53	42	42	33	22	19	25	19
184	1	15	5	0	18	17	27	45	39	33	38	37	51	39	39	30	18	16	22	16
186	7	21	11	5	23	23	32	50	45	38	43	42	56	43	44	34	22	20	26	20
188	0	14	4	0	17	17	26	44	39	32	37	37	50	38	39	29	18	15	22	16
190	-2	11	1	-3	15	14	24	42	37	30	35	35	49	37	37	28	16	13	20	14
192	-15	0	-10	-16	3	3	13	32	26	20	25	25	39	27	28	19	7	4	11	5
194	-29	-14	-23	-29	-9	-8	1	21	15	9	14	15	30	18	18	9	-2	-4	2	-3
196	-23	-8	-18	-23	-3	-3	7	26	21	14	20	20	35	22	23	14	2	0	7	0
198	-23	-8	-18	-23	-3	-3	7	26	21	14	20	20	35	22	23	14	2	0	7	0
200	-29	-14	-24	-29	-9	-9	1	21	16	9	15	15	30	18	19	9	-2	-4	3	-3
202	-34	-19	-29	-34	-13	-13	-2	17	12	5	11	12	27	15	16	6	-5	-7	0	-6
204	-24	-8	-19	-24	-3	-3	7	28	22	15	21	21	36	23	24	14	2	0	7	1
206	-31	-15	-25	-31	-9	-9	2	22	16	9	16	16	32	19	20	10	-2	-4	3	-3
208	-29	-13	-24	-29	-8	-8	3	24	18	11	17	17	33	20	21	11	-1	-3	4	-2
210	-28	-11	-22	-28	-6	-6	4	25	19	12	18	19	34	21	22	12	0	-2	5	-1
212	-26	-10	-21	-26	-5	-5	6	27	21	14	20	20	36	23	23	13	1	-1	6	0
214	-23	-7	-18	-24	-2	-2	9	30	24	16	23	23	38	25	26	16	3	1	8	2
216	-19	-2	-13	-19	2	2	13	34	28	21	27	27	42	29	30	20	6	4	11	5
218	-17	0	-11	-18	3	3	15	36	30	22	28	28	44	30	31	21	8	5	13	6

Table XV. Skill Score Analysis for Selected SRVIS Count Values: Categories 1-5 Versus Category 7

Lower Cutoff Values

Upper Cutoff Values	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
140	-28	-28	-33	-36	-20	-15	-13	-3	-11	-21	-19	-12	6	3	3	-3	-6	-4	2	-2
142	-13	-14	-20	-22	-7	-1	0	9	1	-8	-6	0	18	16	15	8	5	7	14	9
144	-13	-14	-19	-22	-6	-1	0	9	1	-8	-6	0	19	16	16	8	6	8	14	9
146	-7	-8	-14	-17	-1	4	5	15	7	-3	-1	5	24	22	21	13	11	13	19	14
148	-10	-11	-16	-19	-3	1	3	13	5	-5	-3	3	22	20	19	11	9	11	17	12
150	-21	-22	-27	-30	-14	-8	-6	3	-5	-15	-13	-6	13	10	10	2	0	2	8	3
152	-24	-24	-30	-33	-16	-11	-9	0	-7	-18	-15	-8	11	8	8	0	-2	0	6	1
154	-15	-16	-21	-24	-8	-2	0	9	0	-10	-8	0	19	16	15	8	5	7	14	9
156	-9	-9	-15	-18	-2	3	5	15	6	-4	-2	5	25	22	21	13	11	13	20	14
158	-17	-18	-24	-27	-9	-4	-2	8	0	-11	-9	-1	18	15	15	7	4	6	13	8
160	8	6	0	-2	14	20	22	32	23	11	13	20	41	38	37	29	26	28	35	29
162	-4	-4	-11	-14	3	9	11	21	12	0	2	10	31	28	27	19	16	18	25	20
164	0	-1	-8	-11	6	12	14	24	15	3	5	13	34	31	30	22	19	21	28	22
166	-6	-7	-13	-17	1	6	9	19	10	-1	0	8	29	26	26	17	14	17	24	18
168	-9	-10	-16	-19	-1	4	6	17	7	-4	-2	5	27	24	24	15	12	14	22	16
170	1	0	-6	-9	8	14	16	27	17	5	7	15	37	34	33	24	21	24	31	25
172	12	11	4	0	19	25	27	38	28	15	17	25	47	44	43	34	31	33	40	34
174	16	14	7	4	22	28	30	41	31	18	20	28	50	47	46	37	34	36	43	37
176	16	15	8	4	23	29	31	42	32	19	21	29	51	48	47	38	35	37	44	38
178	24	22	15	11	30	36	38	49	39	25	27	35	58	54	53	44	41	43	50	44
180	31	29	22	18	37	44	45	56	45	32	33	41	64	61	60	50	47	49	56	50
182	39	37	29	26	45	51	52	63	52	39	40	48	71	67	66	57	53	55	63	56
184	22	20	13	9	28	35	36	47	37	23	25	33	57	53	52	43	40	42	49	43
186	33	31	24	20	39	46	47	58	47	34	35	43	67	63	62	52	49	51	59	52
188	30	28	21	17	37	43	45	56	45	31	33	41	64	61	60	50	47	49	57	50
190	31	29	22	18	38	44	46	57	46	32	34	42	66	62	61	51	48	50	58	51
192	9	8	0	-2	17	24	26	37	27	13	15	23	48	44	43	33	30	33	40	34
194	-4	-5	-13	-16	4	10	13	25	14	0	3	12	36	33	32	22	19	21	29	23
196	7	5	-1	-5	15	22	24	36	25	11	13	22	46	43	42	32	29	31	39	33
198	15	13	5	2	23	29	31	43	32	18	20	28	53	50	49	39	35	38	46	39
200	7	6	-1	-5	18	23	25	37	26	11	13	22	47	44	43	33	29	32	40	33
202	0	0	-8	-12	9	16	18	30	19	5	7	16	41	38	37	27	23	26	34	28
204	12	11	3	0	20	27	29	42	30	16	18	27	52	48	47	37	34	36	44	38
206	9	7	0	-4	17	24	26	39	27	13	15	24	50	46	45	35	31	34	42	35
208	13	12	3	0	21	28	30	43	31	16	18	28	53	50	48	38	35	37	45	39
210	22	20	12	7	29	36	38	50	39	24	26	35	60	57	56	45	41	44	52	45
212	22	20	12	7	29	36	38	50	39	24	26	35	60	57	56	45	41	44	52	45
214	22	20	12	7	29	36	38	50	39	24	26	35	60	57	56	45	41	44	52	45
216	30	28	20	16	38	45	46	58	47	31	33	42	68	64	63	52	48	51	59	52
218	30	28	20	16	38	45	46	58	47	31	33	42	68	64	63	52	48	51	59	52

Table XVI. Skill Score Analysis for Selected SRVIS Count Values: Category 8 Versus Category 7

CLR REPORTS 242TOTAL REPORTS 3256

SRIR-DAY Count Values

SRVIS Count Values

SRVIS	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120-129	130-139	140-149	150-159	160-169	170-179	180-189	190-199	200-209	TOTAL CLEAR	TOTAL REPORTS	PER CENT CLEAR
0- 9	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	33 3	16 6	28 14	58 12	0 0	0 0	13	35	37.1
10- 19	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 1	33 3	11 9	25 24	21 32	25 54	33 48	33 3	C 0	46	174	26.4
20- 29	0 C	0 0	0 0	0 0	0 0	0 0	0 2	0 0	0 0	50 2	0 13	7 26	11 51	23 84	17 46	25 4	0 0	38	228	16.7
30- 39	0 C	0 0	0 0	0 0	0 0	0 0	0 0	50 2	0 6	8 12	4 25	3 33	8 70	28 53	32 37	50 2	0 0	38	240	15.8
40- 49	0 0	0 0	0 0	0 0	0 1	0 1	0 0	0 3	0 7	0 15	4 22	2 35	13 43	20 44	46 13	0 0	0 0	23	184	12.5
50- 59	0 0	0 0	0 1	0 0	0 0	0 1	0 3	0 1	0 14	8 23	3 31	4 49	6 47	19 36	0 4	0 0	0 0	15	210	7.1
60- 69	0 0	0 0	0 0	0 0	33 3	0 3	50 2	14 7	0 13	0 15	0 33	0 31	5 37	10 19	0 2	0 0	0 0	7	165	4.2
70- 79	0 0	0 1	0 1	0 1	0 1	0 3	0 3	25 8	0 12	0 11	6 15	4 42	5 19	14 7	100 2	0 0	0 0	9	126	7.1
80- 89	0 0	0 0	0 0	0 1	50 2	0 8	0 9	0 5	0 11	14 21	0 32	2 34	11 34	0 11	100 1	0 0	0 0	10	169	5.9
90- 99	0 C	0 0	0 0	0 5	0 4	0 4	25 4	0 6	0 15	0 17	0 37	2 43	0 40	0 8	0 2	0 0	0 0	2	185	1.1
100-109	0 0	0 0	33 3	0 4	0 4	0 6	0 4	14 7	0 11	5 19	0 29	0 29	4 24	0 10	0 0	0 0	0 0	4	150	2.7
110-119	0 0	0 0	33 3	0 3	0 5	0 1	10 10	0 14	0 16	0 18	3 29	3 26	0 18	20 5	0 0	0 0	0 0	5	148	3.4
120-129	0 0	0 1	0 3	25 4	100 1	0 5	0 8	0 9	0 11	0 17	2 38	0 35	0 25	0 6	0 0	0 0	0 0	3	163	1.8
130-139	0 0	0 0	0 5	0 4	0 2	0 7	0 10	7 14	0 11	0 19	3 33	6 31	4 21	0 2	0 0	0 C	0 0	5	159	3.1
140-149	0 0	0 1	0 1	0 5	0 9	0 5	0 13	0 6	0 16	0 27	3 27	4 24	13 15	25 4	0 1	0 C	0 0	5	154	3.2
150-159	0 0	0 1	20 5	14 7	0 7	0 8	0 6	0 14	5 20	0 18	3 31	3 27	0 12	0 0	0 0	0 0	0 0	5	156	3.2
160-169	0 0	0 1	16 6	0 9	10 10	0 9	0 9	0 12	20 10	0 12	5 20	0 29	0 16	0 1	0 0	0 0	0 0	5	144	3.5
170-179	0 0	0 0	0 7	0 9	0 6	16 6	0 10	0 13	0 12	0 12	0 23	0 20	0 13	0 1	0 0	0 0	0 0	1	132	0.8
180-189	0 0	0 2	0 6	0 10	0 3	0 4	0 12	0 6	0 7	0 7	0 15	0 14	0 4	0 1	0 0	0 0	0 0	0	93	0.0
190-199	0 0	0 2	12 8	0 5	0 7	0 11	0 10	0 9	0 5	0 7	0 6	0 5	0 2	100 1	0 0	0 0	0 0	2	78	2.6
200-209	0 0	0 2	0 10	9 11	0 5	20 5	0 2	0 4	0 6	25 4	0 6	0 5	0 0	0 0	0 0	0 0	0 0	3	60	5.0
210-219	0 1	0 2	16 6	14 7	0 2	0 1	0 7	0 2	0 4	0 2	0 3	0 1	0 3	0 0	0 0	0 0	0 0	2	41	4.9
220-229	0 1	0 2	0 5	0 11	0 1	0 4	0 2	0 3	0 2	0 1	0 1	0 1	0 0	0 0	0 0	0 0	0 0	0	34	0.0
230-239	0 2	0 2	0 2	0 1	0 2	0 0	0 0	0 0	0 3	0 0	0 1	0 0	0 0	0 0	0 0	0 0	0 0	0	13	0.0
240-249	0 3	0 2	0 2	0 1	0 1	0 1	0 1	0 0	0 0	0 1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0	12	0.0
250-259	0 0	0 0	0 0	0 1	0 0	0 0	0 0	0 1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0	2	0.0
TOTAL CLEAR	0	0	6	4	4	2	3	6	3	10	11	22	40	75	52	3	0			
TOTAL REPORTS	7	19	76	99	76	93	127	146	213	283	479	567	532	361	168	9	0			
PER CENT CLEAR	0	0	7	4	5	2	2	4	1	3	2	3	7	20	30	33	0			

Table XVII. VIF Diagram: Category 9 Versus Total Reports. Dashed isoline encloses area of 20 or more reports; solid isolines (5 and 10) refer to number of clear reports. See text regarding shaded area.

FOG REPORTS 452TOTAL REPORTS 2968

SRIR-DAY Count Values

SRVIS Count Values	40 49	50 59	60 69	70 79	80 89	90 99	100 109	110 119	120 129	130 139	140 149	150 159	160 169	170 179	180 189	190 199	200 209	TOTAL FOG	TOTAL REPORTS	PER CENT FOG
0- 9	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	50 2	0 4	7 14	0 12	0 0	0 0	2	32	6.3
10- 19	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 1	0 2	28 7	4 23	10 28	5 53	0 47	0 3	0 0	9	164	5.5
20- 29	0 0	0 0	0 0	0 0	0 0	0 0	0 2	0 0	0 0	50 2	30 13	16 24	10 48	10 80	4 42	0 4	0 0	24	215	11.2
30- 39	0 0	0 0	0 0	0 0	0 0	0 0	0 0	50 2	40 5	30 10	9 22	6 32	4 65	5 52	2 36	0 2	0 0	17	226	7.5
40- 49	0 0	0 0	0 0	0 0	0 1	0 1	0 0	0 1	14 7	15 13	13 22	12 33	15 40	2 44	0 13	0 0	0 0	17	175	9.7
50- 59	0 0	0 0	0 1	0 0	0 0	0 1	0 3	0 1	7 13	10 20	13 30	22 40	9 41	5 35	0 3	0 0	0 0	22	188	11.7
60- 69	0 0	0 0	0 0	0 0	0 2	33 3	0 2	0 7	38 13	33 15	14 27	44 29	9 32	5 17	0 2	0 0	0 0	32	149	21.5
70- 79	0 0	0 1	0 1	0 0	0 1	0 2	50 2	12 8	18 11	25 8	28 14	20 39	5 17	0 6	0 2	0 0	0 0	19	112	17.0
80- 89	0 0	0 0	0 0	0 1	0 2	12 8	14 7	0 2	12 8	0 17	17 29	16 31	18 33	22 9	0 1	0 0	0 0	21	148	14.2
90- 99	0 0	0 0	0 0	0 2	50 4	0 4	25 4	33 6	9 11	26 15	29 34	7 39	24 29	0 8	0 1	0 0	0 0	30	157	19.1
100-109	0 0	0 0	0 3	0 4	25 4	16 6	25 4	40 5	10 10	10 19	28 25	7 28	4 22	37 8	0 0	0 0	0 0	21	138	15.2
110-119	0 0	0 0	0 2	0 1	66 3	0 0	20 10	15 13	46 15	5 17	14 28	17 23	12 16	0 5	0 0	0 0	0 0	24	133	16.0
120-129	0 0	0 1	0 3	25 4	0 1	20 5	28 7	14 7	10 10	31 16	16 36	15 31	19 21	33 6	0 0	0 0	0 0	29	148	19.6
130-139	0 0	0 0	20 5	50 4	50 2	16 6	30 10	23 13	36 11	25 16	13 29	10 29	9 21	0 0	0 0	0 0	0 0	28	146	19.2
140-149	0 0	0 1	0 1	25 4	33 9	20 5	45 11	50 4	20 15	27 22	14 27	31 22	14 14	0 4	0 1	0 0	0 0	33	140	23.6
150-159	0 0	0 1	0 5	28 7	14 7	37 8	40 5	25 12	5 17	[illegible] 16	17 29	20 25	9 11	0 0	0 0	0 0	0 0	24	143	16.8
160-169	0 0	0 1	0 6	0 8	0 9	37 8	12 8	16 12	10 10	27 11	11 18	11 27	20 15	0 1	0 0	0 0	0 0	20	134	14.9
170-179	0 0	0 0	28 7	42 7	20 5	33 6	30 10	16 12	18 11	22 9	28 21	[illegible] 20	8 12	0 1	0 0	0 0	0 0	26	121	21.5
180-189	0 0	0 2	12 8	11 9	66 3	0 4	54 11	0 6	16 6	0 5	25 12	21 14	0 3	0 1	0 0	0 0	0 0	17	84	20.2
190-199	0 0	0 1	14 7	25 4	33 6	20 10	22 9	12 8	40 5	14 7	16 6	20 5	0 2	0 1	0 0	0 0	0 0	14	71	19.7
200-209	0 0	0 2	30 10	40 10	0 4	20 5	0 1	33 3	0 5	25 4	0 6	0 4	0 0	0 0	0 0	0 0	0 0	10	54	18.5
210-219	0 1	0 2	16 6	0 6	0 2	100 1	0 7	50 2	50 4	0 2	33 3	100 1	0 2	0 0	0 0	0 0	0 0	7	39	17.9
220-229	0 1	0 2	25 4	20 10	100 1	0 3	0 2	0 3	0 2	0 1	0 1	0 1	0 0	0 0	0 0	0 0	0 0	4	31	12.9
230-239	0 2	0 1	0 2	100 1	0 1	0 0	0 0	0 0	0 2	0 0	0 1	0 0	0 0	0 0	0 0	0 0	0 0	1	10	10.0
240-249	0 3	0 2	0 1	0 0	0 0	0 1	0 0	0 0	0 0	0 1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0	8	0.0
250-259	0 0	0 0	0 0	100 1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1	1	100.0
TOTAL FOG	0	0	10	19	16	18	30	24	38	44	81	89	54	26	3	0	0			
TOTAL REPORTS	7	17	72	83	67	87	115	127	192	248	440	522	476	345	160	9	0			
PER CENT FOG	0	0	13	22	23	20	26	18	19	17	18	17	11	7	1	0	0			

Table XVIII. VIF Diagram: Category 5 Versus Total Reports (With Categories 1-4 and 6 Removed). Dashed isoline encloses area of 20 or more reports; solid isolines (3 and 5) refer to number of heavy fog reports. See text regarding shaded area.

Upper Cutoff Values \ Lower Cutoff Values	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92
130	28	28	27	27	26	27	26	26	27	25	25	25	24	23	22	23	22	22	21	21
132	28	28	27	27	26	27	26	26	27	25	25	25	24	23	22	23	22	21	21	21
134	31	30	30	30	29	30	29	29	29	28	27	27	27	26	25	25	25	24	24	24
136	33	33	32	32	31	32	31	31	32	30	30	30	29	28	27	27	27	26	26	26
138	36	36	36	35	35	36	35	34	35	34	33	33	32	31	30	31	30	29	29	29
140	41	40	40	40	39	40	39	38	39	38	37	37	36	35	34	34	34	33	33	32
142	43	43	42	42	41	42	41	41	41	40	39	39	38	37	36	36	36	35	35	34
144	51	51	51	50	49	50	49	48	49	48	47	46	45	44	43	44	43	42	42	41
146	58	58	58	57	56	57	56	55	56	54	53	53	51	50	49	50	49	48	47	47
148	68	67	67	66	65	66	65	64	65	63	62	61	60	58	57	58	57	56	55	55
150	76	76	75	74	73	74	73	72	72	70	69	69	67	65	64	65	64	62	62	62
152	86	86	85	84	83	84	83	82	82	80	78	78	76	74	73	73	72	71	70	70
154	99	99	98	97	96	97	95	94	94	92	90	89	87	86	84	84	83	81	81	80
156	110	110	109	108	107	107	105	104	104	101	99	99	96	94	93	93	92	90	89	88
158	123	122	121	120	119	120	118	116	116	113	111	110	107	105	103	103	102	100	99	98
160	130	130	128	127	126	126	124	122	123	119	117	115	112	110	108	109	107	105	104	103
162	146	145	144	143	141	141	139	137	137	133	130	128	125	123	121	121	119	116	115	114
164	160	159	158	156	154	155	152	149	149	145	141	140	136	133	131	131	128	126	124	123
166	173	173	171	170	167	168	165	162	161	156	152	150	146	143	140	140	137	134	133	132
168	185	184	182	180	178	178	175	171	170	165	160	158	153	149	147	146	144	140	139	137
170	210	209	207	205	202	202	198	193	192	185	180	177	172	167	164	164	160	156	155	153
172	212	211	208	206	203	203	198	194	192	185	180	176	170	166	162	162	158	154	152	150
174	205	204	201	199	195	195	190	185	184	176	170	166	160	155	152	151	148	143	141	139
176	191	190	187	184	181	181	176	170	169	161	155	151	144	140	136	135	132	127	125	123
178	182	181	177	174	170	170	165	159	158	149	142	139	132	126	122	122	118	113	112	110
180	160	160	156	152	148	149	143	137	137	127	121	118	111	105	101	101	98	93	91	89
182	138	137	133	130	125	127	120	114	115	105	99	96	89	84	80	81	77	72	71	69
184	112	111	106	103	98	101	94	89	91	81	75	73	67	61	57	59	56	50	50	48
186	80	79	75	71	67	71	65	60	64	54	49	48	42	37	33	35	33	28	28	27
188	31	30	26	23	19	25	20	17	23	15	11	12	8	3	0	3	1	-2	-2	-2
190	16	16	12	9	5	12	7	4	12	4	0	2	-1	-6	-9	-5	-6	-11	-10	-10
192	-2	-2	-5	-8	-12	-4	-9	-11	-2	-10	-12	-10	-14	-18	-21	-17	-18	-22	-21	-21
194	0	-1	-4	-7	-11	-3	-8	-10	-1	-9	-12	-10	-13	-17	-20	-16	-17	-21	-20	-20
196	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20
198	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20
200	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20
202	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20
204	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20
206	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20
208	0	0	-4	-7	-10	-2	-8	-9	-1	-9	-11	-9	-13	-17	-20	-16	-17	-21	-20	-20

Table XIX. Skill Score Analysis for Selected SRIR-DAY Count Values: Category 9 Versus Total Reports

Upper Cutoff Values (rows) / Lower Cutoff Values (columns)

	16	19	22	25	28	31	34	37	40	43	46	49	52	55	58	61	64	67	70	73
174	7	36	60	73	71	82	84	81	93	95	97	95	96	93	87	80	75	76	70	69
176	12	41	66	79	76	87	89	86	97	99	101	99	100	97	90	83	78	79	73	72
178	15	45	70	83	80	91	93	89	101	102	104	102	103	99	93	86	80	81	75	73
180	19	49	74	86	83	94	96	92	103	105	106	105	105	102	95	88	82	83	77	75
182	27	57	82	94	90	101	102	98	109	110	112	110	110	106	99	92	86	87	80	79
184	34	64	89	101	97	107	108	103	114	115	116	114	114	111	103	95	90	91	84	82
186	38	69	94	105	101	111	112	107	118	118	120	117	117	113	105	98	92	93	86	84
188	40	71	96	107	103	113	113	109	119	120	121	119	118	114	107	99	93	94	87	85
190	45	76	101	112	107	117	117	112	123	123	124	122	121	117	109	101	95	96	89	87
192	47	78	103	114	109	119	119	114	124	125	126	123	123	119	110	102	96	97	90	88
194	52	83	108	119	113	123	123	117	128	128	129	126	125	121	113	105	98	99	92	90
196	58	89	114	124	118	127	127	121	131	131	132	129	129	124	116	107	101	102	94	92
198	58	90	115	125	119	128	128	122	132	132	133	130	129	125	116	108	101	102	94	92
200	60	92	118	128	121	130	130	124	134	134	134	131	131	126	117	109	102	103	95	93
202	64	96	121	131	124	133	133	126	136	136	137	133	132	128	119	110	104	104	96	94
204	67	100	125	135	128	137	136	129	139	139	139	136	135	130	121	112	105	106	98	96
206	72	105	130	139	132	140	139	132	142	141	142	138	137	132	123	114	107	108	100	97
208	74	107	132	141	134	142	141	133	143	143	143	139	138	133	124	115	108	108	100	98
210	74	107	133	142	134	142	141	134	144	143	143	140	139	133	124	115	108	109	100	98
212	71	106	132	141	133	142	141	133	143	143	143	139	138	133	124	114	108	108	100	98
214	75	109	136	144	136	145	143	136	145	145	145	141	140	135	125	116	109	109	101	99
216	80	114	140	148	140	148	146	138	148	147	147	143	142	137	127	118	110	111	103	100
218	83	117	143	151	142	150	148	140	149	149	149	145	143	138	128	119	112	112	104	101
220	86	121	146	154	145	152	151	142	151	151	150	147	145	139	129	120	113	113	105	102
222	89	123	148	156	146	154	152	143	153	152	152	148	146	140	130	121	114	114	105	103
224	92	126	151	158	149	156	154	145	154	153	153	149	147	142	132	122	115	115	106	104
226	95	129	154	161	151	158	156	147	156	155	155	151	149	143	133	123	116	116	107	105
228	99	133	158	165	154	161	159	149	158	157	157	152	150	145	134	124	117	117	109	106
230	102	135	160	166	156	163	160	151	159	158	158	153	151	146	135	125	118	118	109	107
232	104	137	162	168	157	164	161	152	160	159	158	154	152	146	136	126	118	119	110	107
234	105	138	163	169	158	165	162	152	161	160	159	155	153	147	136	126	119	119	110	107
236	107	141	165	171	160	166	163	154	162	161	160	156	154	148	137	127	119	120	111	108
238	108	141	166	171	160	167	164	154	163	161	160	156	154	148	137	127	120	120	111	108
240	110	143	168	173	162	168	165	155	163	162	161	157	155	149	138	128	120	120	111	109
242	111	144	169	174	163	169	166	156	164	162	162	157	155	149	138	128	121	121	112	109
244	113	146	170	175	164	170	167	157	165	163	163	158	156	150	139	129	121	121	112	110
246	114	147	172	176	165	171	167	157	166	164	163	159	156	150	139	129	122	122	113	110
248	116	149	173	178	166	172	169	158	167	165	164	159	157	151	140	130	122	122	113	111
250	116	149	173	178	166	172	169	158	167	165	164	159	157	151	140	130	122	122	113	111
252	118	150	174	179	167	173	169	159	167	165	165	160	158	151	140	130	122	123	114	111

Table XX. Skill Score Analysis for Selected SRVIS Count Values: Category 9 Versus Total Reports

LIST OF REFERENCES

Hesse, T. S. and Stevenson, N. M., 1968: 1962-1968 Monthly Surface Hemispheric Means, Standard Deviations, and Diurnal Variations. Technical Note 43. Fleet Numerical Weather Central, Monterey, California 28 pp.

National Environmental Satellite Service, 1973: Key to Meteorological Records Documentation (KMRD) No. 5.4, Environmental Satellite Imagery. Environmental Data Service, Washington, D. C., v.p.

Panofsky, Hans A. and Brier, Glenn W., 1968: Some Applications of Statistics to Meteorology. The Pennsylvania State University, University Park, Pennsylvania, 224 pp.

Renard, R. J., Englebretson, R. E. and Daughenbaugh, J. S., 1975: Climatological Marine Fog Frequencies Derived from a Synthesis of the Visibility-Weather Group Elements of the Transient-Ship Synoptic Reports. NPS-51Rd75031, Naval Postgraduate School, Monterey, California, 40 pp.

Wallace, R. T. and Renard, R. J., 1975: The Use of Meteorological Satellites for Discerning Marine Fog. NPS-51Wa75031, Naval Postgraduate School, Monterey, California, 59 pp.

Willms, G. R., 1975: A Climatology of Marine-Fog Frequencies for the North Pacific Ocean Summer Fog Season. M. S. Thesis, Department of Meteorology, Naval Postgraduate School, Monterey, California, 59 pp.

Wheeler, S. E., 1974: Marine Fog Impact on Naval Operations. M. S. Thesis, Department of Oceanography, Naval Postgraduate School, Monterey, California, 118 pp.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Documentation Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0212 Naval Postgraduate School Monterey, California 93940	2
3.	Department Chairman, Code 51 Department of Meteorology Naval Postgraduate School Monterey, California 93940	2
4.	Dr. Robert J. Renard, Code 51Rd Department of Meteorology Naval Postgraduate School Monterey, California 93940	10
5.	Dr. Dale F. Leipper, Code 58 Department of Oceanography Naval Postgraduate School Monterey, California 93940	1
6.	Dr. Glenn W. Jung, Code 58 Department of Oceanography Naval Postgraduate School Monterey, California 93940	1
7.	Professor G. E. Schacher, Code 61Sq Department of Physics and Chemistry Naval Postgraduate School Monterey, California 93940	1
8.	Commanding Officer Fleet Numerical Weather Central Monterey, California 93940	1
9.	Commanding Officer Environmental Prediction Research Facility Monterey, California 93940	1
10.	Mr. Paul Lowe Environmental Prediction Research Facility Monterey, California 93940	1

11. Mr. Roland Nagle 1
Environmental Prediction Research Facility
Monterey, California 93940

12. Commander, Naval Weather Service Command 1
Naval Weather Service Headquarters
Washington Navy Yard
Washington, D. C. 20390

13. Mr. Murray H. Schefer 3
AIR-370C
Naval Air Systems Command
Washington, D. C. 20360

14. Library, Code 3330 1
Naval Oceanographic Office
Washington, D. C. 20373

15. Dr. Lothar Ruhnke 1
Naval Research Laboratory
Washington, D. C.
Code 8320

16. Dr. Dee F. Taylor 1
Naval Air Systems Command
AIR-540
Washington, D. C. 20360

17. Dr. Alan Weinstein 1
Stratiform Cloud Physics Fr.
Meteorology Laboratory
Department of the Air Force
Air Force Cambridge Res. Lab.
Laurence G. Hanscom Field
Bedford, Massachusetts 01730

18. Dr. Pierre St. Amand 1
Earth and Planetary Sci. Div.
Code 602
Department of the Navy
Naval Weapons Center
China Lake, California 93555

19. Mr. James Hughes 1
Office of Naval Research
Code 412
Arlington, Virginia 22217

20. Dr. Thomas E. Hoffer 1
Desert Research Institute
University of Nevada
Reno, Nevada 89502

21. Dr. Patrick Squires 1
Desert Research Institute
University of Nevada
Reno, Nevada 89507

22. Mr. Roland Pilie 1
Calspan Corporation
Buffalo, New York 14221

23. National Center for Atmospheric Research 1
Library Aquisitions
Boulder, Colorado 80301

24. Dr. James L. Kassner, Jr. 1
Graduate Center for Cloud Physics Research
University of Missouri
Rolla, Missouri 65401

25. Mr. Francis J. Biernacki 1
269 Camino Elevado
Bonita, California 92002

26. Lieutenant Donald E. Hinsman 1
Fleet Numerical Weather Central
Monterey, California 93940

27. Lieutenant Richard T. Wallace 1
USS New Orleans (LPH 11)
FPO San Francisco 96601

28. Lieutenant Ronald E. Hale 5
484 Hale Street
Chula Vista, California 92010

Thesis 162714
H1385 Hale
c.1 Use of the NOAA-2
digitized satellite data
for diagnosing marine
fog in the North Pacific
Ocean area.